

The AMSAT[®] Journal

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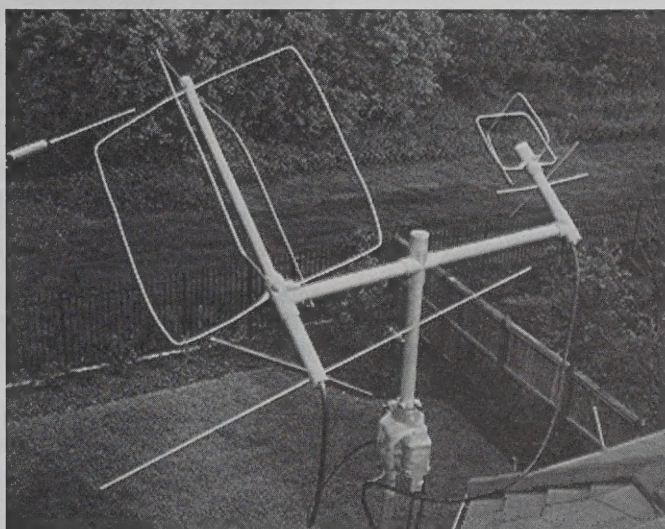
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SUNSAT Ready for Orbit!
See page 7 for details.



This prototype installation of the *Texas Potato Masher* at 45 degrees with azimuth (TV) rotator. The author later determined 30 degrees elevation worked best for low passes and equalized the gain a little better for high passes when the birds are closer.

The Texas Potato Masher: A Medium-Gain Directional Satellite Antenna For LEOs

Jerry Brown, K5OE (k5oe@amsat.org)

Putting together a station for working satellites, even the *Easy Sats*, can be a bewildering exercise. The current fleet of amateur satellites present many combinations of mode of communication, hardware requirements and antenna selection. The ultimate antenna system consists of high-gain beam antennas with remote-polarity switching and fully automated computer-controlled tracking. Many amateurs work satellites with a simple, omnidirectional antenna—but not nearly as well. What about something in between?

This article presents an easy-to-replicate, medium-gain, circularly-polarized antenna that can be easily built for both 2 meters and 70 centimeters. The only test equipment required is an SWR meter used for calibration. All materials are available at your local hardware store for under \$10.00. I have

[continued on page 4]

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Let's Use What We Have

By Keith Baker, KB1SF

Now that the dust has settled a bit since being appointed as your new President, I and the rest of our management team have been beginning to lay out a plan of work that will take the organization into the next century.

Of course, there is still much unfinished business on our plates that must also be accomplished as we proceed with those plans. Chief among them is finding a safe and affordable launch for Phase 3D. I am happy to report to you that Dr. Karl Meinzer, DJ4ZC, and his AMSAT-DL team are continuing their productive talks with a number of launch agencies in that regard. And, while nothing firm has yet materialized as this edition of our Journal goes to press, you should not assume that our lack of public discussions regarding these issues also implies a lack of progress.

As I am sure that those of you who have negotiated such contracts will agree, talking in public about these negotiations while they are ongoing could seriously jeopardize our ultimate prospects for a launch. So, for that reason, don't expect to hear a public, step-by-step accounting of DJ4ZC's progress as it happens. On the other hand, rest assured, once a firm launch opportunity has been secured for Phase 3D, you'll certainly be the next ones to know about it, as we will be shouting the news from the rooftops via our ANS bulletins!

In addition to Phase 3D there are a number of new satellites on the drawing boards as well (see pages 30-31). Some are being readied for launch as I write this. If even half of them successfully make it to orbit and are activated, they will offer us more on-orbit capabilities than we could possibly imagine. Satellites with names like MOST, Citizen Explorer, JAWSAT, ASUSat, SUNSAT, ARISS and a number of others may soon provide us with even more transponder capacity and capability than we currently have.

But, while we look to the future, I believe we also need to realize just how much we have been blessed with the number of different analog and digital satellites already in orbit. Sadly, I think it is also safe to say that most of our satellites are underused right now.

Of course, there are some exceptions, most notably AO-27 and RS-12/13 that come to mind. These satellites appear to be quite busy on North American passes. However, on the other hand, and by my own personal observations, there are a number of other satellites that have FAR greater transponder capacity than is being used by our members and others right now.

For example, on passes over the USA, the Fuji satellites FO-20 and FO-29, both of which are in the analog mode at this writing, appear to be only lightly loaded. There are a number of *regulars* that meet on these birds, but most conversations still appear to be clustered around the center of the passband, and just a handful of the same callsigns are usually heard, even on weekends. Likewise RS-15, a Mode A bird, appears to only be lightly loaded as it passes over North America. I've called "CQ" on this satellite (on both voice and CW) on numerous passes over the USA, and had absolutely no reply, nor did I hear any other activity in the passband. On the digital side, while UO-22, KO-23, and KO-25 appear to be quite busy with many stations in the queue, AO-16 and LO-19 activity is going begging.

Now, granted, our natural human tendency is to always want *more* of a good thing, or to demand more of the same kind of satellite that we happen to be equipped to use right now. However, some of our more senior members can probably still remember back to a time when we had only ONE satellite in orbit at any one time, and its lifetime was measured in weeks or months—not years. Nowadays, we have by my count, some 15 more or less active satellites available for our use, and that's not even counting the *Mir* and Shuttle activities!

I also realize that working some of our current satellites is a challenge. For example, RS-15's downlink is often very weak, and AO-10 suffers from an *on-again-off-again* schedule and deep fades on the downlink. But a number of other analog satellites, the Fuji OSCARS in particular, are working just beautifully and yet, by my own observation, remain only lightly loaded on their North American passes.

So, while we await the launch of Phase 3D and the number of other satellites that are now awaiting launch or are on the drawing boards, I suggest you make yourself a New

Year's Resolution to try something new and different with the number of satellites we currently have in orbit. If you have never tried using the digi-sats, go for it! Conversely, if most of your operation has been digital in the past years, make it a point to also cruise by the analog passbands now and then and have a conversation or two with some of the nice folks you'll meet there.

Or, how about giving CW a try on the lower ends of some of our satellite passbands? For those of you who are thinking about upgrading to a coded license here in the USA, I can think of no better way to get actual on-air code practice than to make regular forays into the lower ends of our analog satellite passbands and to get your feet wet with some **real** CW QSOs! In fact, my own personal resolution this year is to spend a lot more of my satellite operating time working CW on our analog passbands.

And, before you say, "I can't afford that", make yourself another resolution to look around at upcoming hamfests, flea markets and yes, even the Internet-based swap pages for an upgraded satellite radio, modem and/or antennas. With all the new satellite radios that have come to market in recent years, there are a NUMBER of nearly-new pieces of equipment available to get you going on that new mode or that different satellite. Many are going begging on the "For Sale" table right now, often at bargain-basement prices.

Many satellite groups from around the world have expended considerable time, effort and MONEY to build and launch the many satellites that are currently in orbit. The very least we can do to say *thank you* to these fine people is to make it a point to regularly use their handiwork!

See you on the birds! ■

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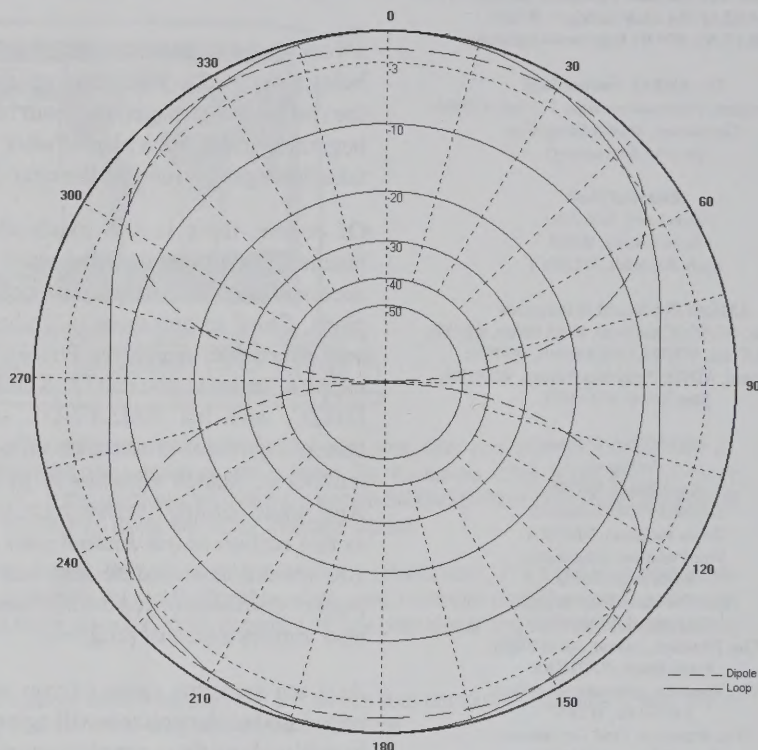


Figure 1: Dipole / Loop Azimuth Comparison

[Texas Potato Masher from page 1]

successfully worked *all* the current Low Earth Orbit (LEO) analog satellites with prototype versions of these antennas, and can copy the 2 meter downlink of AO-10.¹

Background

My quest for a *better* antenna for LEO satellites began with dissatisfaction with available antennas, both omnidirectional and high-gain beams.

I built several of the popular *eggbeaters* and found them to be an irritating compromise. Without radials, they performed better than turnstiles, and much

better than a ¼ wavelength ground plane for low elevation passes, but had severe overhead nulls. With radials they performed exceptionally well for high elevation passes, but were dead below 20 degrees elevation. I believe the enhanced high-elevation performance is due as much to the excellent circularity of the basic design above 45 degrees as it is to the added gain from the *reflector* radials.² Another significant benefit I found to the basic eggbeater design is the higher input impedance greatly eases the matching burden for multiple driven elements when compared to a dipole-turnstile arrangement.

While my experience in building high-gain Yagi antennas has met with mixed results, the successful antennas were also disappointing for LEO communications. I found manually tracking the LEOs to be too much work while I compensate for Doppler shift and try to make log notes. The narrow beamwidth of a high gain antenna is an

unfortunate tradeoff. What I really wanted was a lower gain, thus a wider beamwidth, antenna with good circularity. For simplicity I chose to stick with right-hand-circular polarization (RHCP) rather than build in a switching scheme.

Design

I thought if I could improve the overhead lobe of the basic eggbeater design, I could mount the antenna on a small rotator and tilt it 45 degrees and have adequate performance, while requiring only one or two azimuth adjustments per pass. A 90 degree half-power beamwidth in both azimuth and elevation, as opposed to the eggbeater's omnidirectional pattern, is the goal.

The prototype design is formed around a pair of full-wave loops. A full wave loop, while having a radiation pattern similar to a dipole, has about 1 dB gain over a dipole (in the *normal* plane off the sides) and a radiation resistance of approximately 120 ohms.³ See Figures 1 and 2 for pattern comparisons. Two loops, arranged in a turnstile fashion, produce an omnidirectional pattern.⁴

Unlike the eggbeater however, the *driven* loop in this design is formed as a square, similar to a quad or quagi beam. This is done to move the high current portion of the loop parallel to a parasitic reflector element positioned *below* the loop. Note this arrangement provides gain in the axis perpendicular to the boom (in the *coaxial* plane off the top) of a common quad or quagi. The reflector is placed 0.1 wavelength from the driven element to provide maximum forward gain.⁵ Empirical results indicate this lowers the input impedance to almost 75 ohms and introduces some negative reactance. (More on this later). Testing with the field strength meter proved to be quite revealing, and provides the elevation and azimuth patterns shown in Figure 3. Theoretical gain is 6 dBi, with an estimated front-to-back ratio of 11 dB.

Construction

Materials are not critical. 10 gauge wire stripped from common 10/2 house wiring (leaving on the PVC jacket) and 1" PVC pipe and fittings are used in the prototype models. The 2 meter model uses 3/16" aluminum rod for the reflectors, but 1/8" bronze welding rod would work equally well.⁶ Use of 12 gauge wire and 3/4" PVC are perfectly adequate for the 70 cm antenna. All

Table 1

	436 MHz	146 MHz
Loop Length (*)	28 - 1/4"	79"
Reflector Length	13 - 1/4"	39 - 5/8"
Reflector Spacing	2 - 1/2"	7 - 5/8"
Phasing Line Length (**)	5 - 5/8"	16 - 3/8"
Test Cable Length (***)	10 - 3/16"	15 - 3/16"

(in inches)

* 3/4" at each end included for connecting to hardware

** based on nominal RG-62A. Verify with coax tee and dummy load procedure.

*** based on RG-8X with VF=.79. Verify with coax tee and dummy load procedure.

stainless steel hardware, size 6-32, is used, but brass would work as well. Crimp-style ring lugs are used to connect the coaxial cables to the hardware.

Cut the first driven element to the specified dimension shown in Table 1. I allowed 3/4" at each end to be stripped and *curled* for connection of the hardware. These dimensions are for the design frequencies of 146 MHz and 436 MHz. Form into a square, as shown in Figure 4. Prepare a PVC coupling by drilling 4 holes, 90 degrees apart. Using 1/2" long 6-32 bolts, washers, and nuts, connect one 50 ohm test cable (RG-8X used in the prototypes) of either 1/2

wavelength (2 m) or 1 wavelength (70 cm). This test cable will provide accurate SWR readings unaffected by the impedance mismatch of the cable to the antenna.

Minimum SWR should be about 2.2:1, indicating 120 ohms impedance. The resonant point should occur around 145.5 MHz and 434 MHz. The lower *test* frequency is designed to offset the negative reactance introduced with the later addition of the reflector element. Next, while reading SWR at the *design* frequency, move the reflector up and down below the square driven element until minimum SWR is achieved. This should be about 1.5:1,

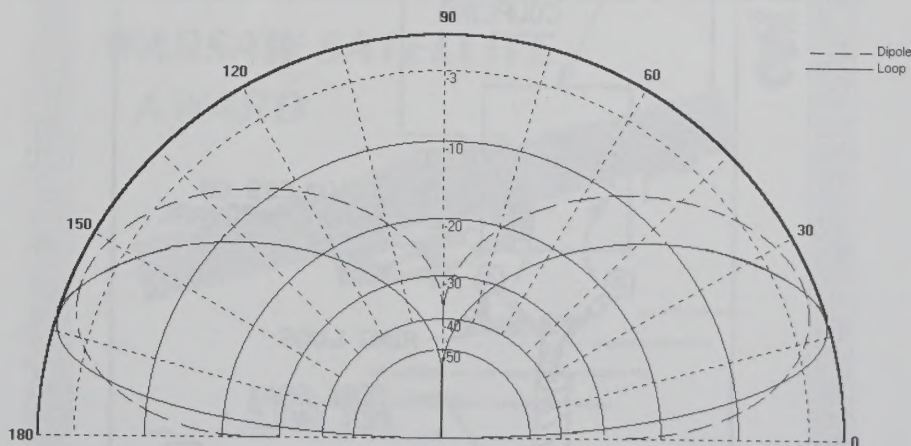


Figure 2: Dipole/Loop Elevation Comparison

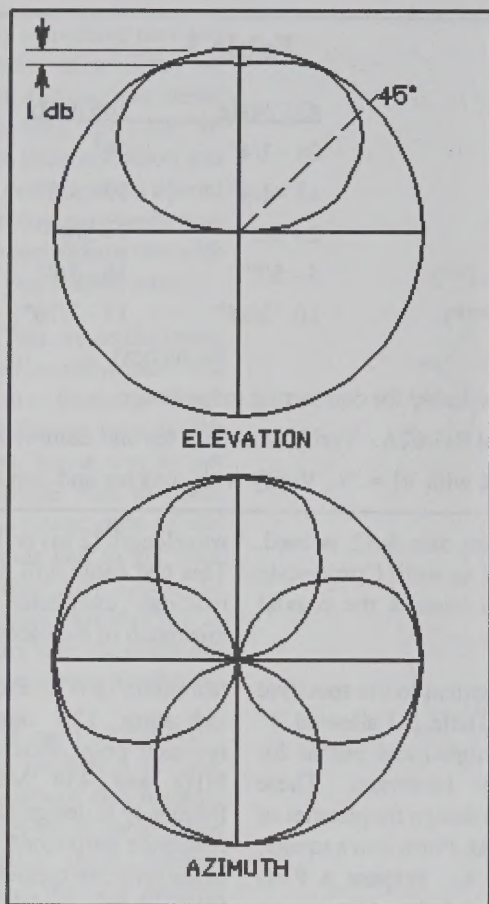


FIGURE 3: PROTOTYPE PATTERNS

Figure 3. Prototype Relative Strength Patterns.

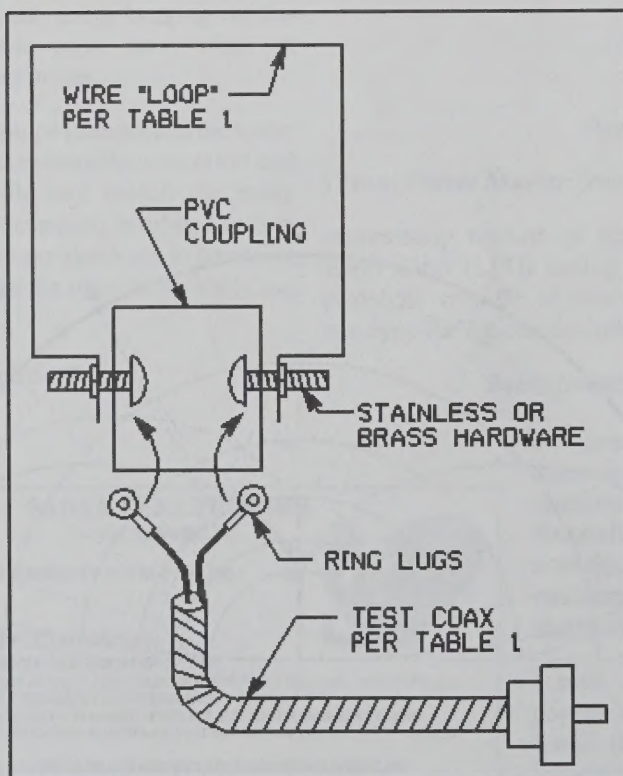


FIGURE 4: ASSEMBLY/TESTING

Figure 4. Assembly Directions.

indicating approximately 75 ohms input impedance. This occurred exactly as expected in the prototypes, at 0.1 wavelength below the full wave driven element. Finally, prepare a $\frac{1}{4}$ wavelength delay line of 92 Ohm coaxial cable (RG-62) and connect as shown in Figure 5 with the final 50 Ohm cable such as flexible 9913. The resultant SWR should be below 1.2:1 at the design frequency (calculated impedance of 45 ohms at resonance)

Performance

This design is inherently broadband due to the full-wave loop driven element. The antenna easily handles all of the current satellite frequencies without retuning. The coaxial performance of this single reflector design provides approximately 90 degrees of azimuth (off the top) and elevation (also measured off the top) beamwidth. My test equipment is not sensitive enough to accurately determine F/B ratio, but my on-the-air observations substantiate it must be at least the anticipated 11 dB, and might even exceed my expectations.

I do note a very noticeably higher, about 3 dB, relative strength reading when the receiving antenna is in the same plane as the 0 degree driven element. I believe this is due to an intrinsic design flaw. The 90 degree phasing line causes unequal currents to flow in each driven element and there is no balun to choke off current flowing on the coax. The use of a balanced matching/phasing section (like that employed in the commercial M² design) would likely fix this mismatch, but adds considerable complexity.⁷ I mounted the 70 cm antenna with the 0 degree driven element horizontal, maximizing horizontal (linear) polarization at the horizon, and mounted the 2 meter antenna at 45 degrees to minimize the height profile. An Alliance U-110 (TV type) rotator, commonly used as an elevation rotator, is employed for azimuth control⁸ (see photograph on page 1).

In actual practice, I find the antenna to be excellent for mode JA birds, FO-20 and FO-29, which can be worked from horizon-to-horizon. For AO-27, I found the antenna adequate, but the horizontal 0 degree driven element actually penalizes me on this bird. I found it effective to *off-point* by about 45 degrees in azimuth. The 2 meter version has become my standard Mode A uplink antenna for RS-12 and RS-15, with a discernible uplink improvement of at least 6 dB over my $\frac{1}{4}$ wavelength ground plane

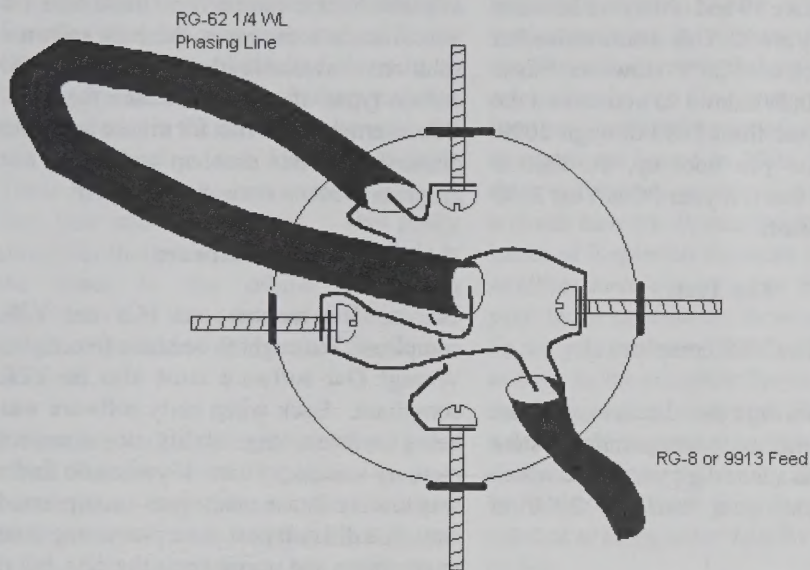


Figure 5. Phasing Line Connection (View from Bottom).

antenna. Later experimentation indicates an elevation angle of 30 degrees is about optimum for maximizing gain at the horizon and still avoiding an overhead null. In summary, these circularly polarized, coaxial-axis parasitic, full-wave turnstile antennae are easy to build and replicate and they work well. Build them yourself and see! See you on the birds.

Notes

1. For a more detailed description of these Amateur Radio satellites, visit: <http://www.amsat.org>.
2. Commercial versions of the eggbeater antenna are available from M², Fresno, CA.
3. *The ARRL Antenna Book*, 16th Ed., 1992, p. 5-2.
4. *Ibid.*, p. 3-11.
5. *Ibid.*, pp. 11-2, 11-3.
6. 3/16" solid aluminum rod available from Texas Towers, Plano, TX
7. Martin Davidoff, *The Radio Amateur's Satellite Handbook*, 1998, pp. 10-16, 10-17.
8. Alliance U-110 rotators available from Norm's Rotor Service, Frederick, MD. ■

14 January 1999 along with two smaller spacecraft, Denmark's Ørsted and SUNDAT. Following a weather briefing, officials made the decision to reschedule the mission for Tuesday, 19 January 1999. The postponement was based on the need for crew rest and the unlikely improvement in wind conditions over the next day or two, officials said.

Local resident and AMSAT member Cliff Buttschardt, K7RR has been providing South Africans assistance during their launch campaign and has been reporting developments via amsat-bb. Cliff reports that despite the launch delays the South Africans are confident of their efforts and look forward to orbiting a successful payload. For an overview of SUNDAT see the Sep/Oct 1998 issue of *The AMSAT Journal* and monitor AMSAT News Service for updates. ■

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SUNDAT Ready for Orbit!

At press time, SUNDAT, the South African-built Amateur Radio satellite was ready for launch on a Delta 2 rocket from Vandenberg Air Force Base, California. The two-stage Boeing rocket, carrying the Air Force's Advanced Research and Global Observation Satellite as its primary payload was scheduled for launch on Thursday,



Warsaw Satellite Award Available: To obtain this satellite award send a photocopy of the QSL confirming your radio satellite contact with Warsaw, Poland to: Mark Staniszewski, SP5FKW, Warsaw, Chkopiciego str. 11/13m, 71 Poland. Please include 7 International Reply Coupons when submitting your award request. (Many thanks to Andy MacAllister, W5ACM and John Scarella, WA5TWT for providing this information.)

The Year 2000 Transition: Your PC and AMSAT Software

Roy D. Welch, W0SL (w0sl@amsat.org)

As we approach the year 2000, there are some items we need to begin to check out in our computers and the software that is running on them to be sure that the date and time sensitive software will function during and after the transition from December 31, 1999 to January 1, 2000.

The PCs

Most computer software that uses the current date and time, gets that information from the PC operating system. The operating system, DOS, Windows, etc., is just software that disappears when the PC is turned off. From where then, does the operating system get this information?

At boot time the operating system is loaded and reads the CMOS Real Time Clock (RTC) which remains running on a backup battery when the PC is powered off. This RTC is hardware in the PC. The CMOS RTC maintains a two digit year value, so the PC BIOS appends these two digits to a pair of stored century digits making the four digit year value that the operating system obtains.

The RTC does not have the century digits and therefore cannot increment them when the year changes from 1999 to 2000. The RTC then just turns over from 99 to 00. The earlier PC BIOS systems only stored the century value of 19. No one was worried about the year 2000 back then. It was a long way off. Now when the year rolls over from 1999 to 2000 you would logically expect this to cause the programs run in those PCs to think the date is 1900. If the program takes its date input directly from the BIOS, that is what will happen. However, if the program gets the date from the operating system, it will think the year is 1980. This is because the operating systems that were designed back in 1984 had no need for supplying current dates earlier than the 1980's. So when the PC boots up with the RTC showing the year 00, the operating system tries to make this 1900, but discovers this is an invalid date and defaults to 1980. How many of you remember booting up one of the older PCs that had a dead ROM backup battery, or even no RTC at all? It probably showed the date of April 1, 1980.

Generally, machines that have been manufactured more recently have BIOS systems that have the ability to decide that the century year is either 19 or 20. You might

infer that deep in the BIOS there must be some decision tree that says if the year digits are between 80 and 99, for example, the century digits are 19 and if they are between 00 and 79 they are 20. This would mean that all would be ok until 2079. However, this is not the case. In Windows 95 you can set the date to any year from 1980 through 2099. The next time you boot up, the date is remembered, that is if your PC is Year 2000 (Y2K) compliant).

The Tests

Your PC will be Y2K compliant if:

1. The RTC two digit year date is read at boot time and is furnished to the operating system by the BIOS as a four digit year value which will increment from 1999 to 2000 at midnight.
2. Then after rebooting, the correct 2000 date will be furnished to the operating system by the BIOS.
3. The year 2000 will correctly accept February 29, 2000 as a valid date. The leap year rules say that any year evenly divisible by four, shall have an extra day added, EXCEPT for century years, EXCEPT for century years evenly divisible by four hundred. In other words, the years 1600 and 2000 are leap years since they are evenly divisible by both four and four hundred. However the years 1500, 1700, 1800, 1900 and 2100 which are evenly divisible by four, but not by four hundred, are not leap years.

How can you tell if your PC is Y2K compliant? There are three manual tests you can make which will help you determine this.

First, set your system date and time to December 31, 1999 and the time to about two minutes before midnight. Turn your PC off and wait for three or four minutes. Then reboot and check that the system date and time displayed are a few minutes after midnight on January 1, 2000.

Secondly, set the date to any date after January 1, 2000, except February 29, 2000. Power down the PC and reboot. Check that the date shown is still the same date you set.

Lastly, try to set the system date to February 29, 2000.

If any of these tests fail, your PC is not Y2K compliant. If you want to perform a more thorough test, there are software programs available which can perform these tests for you. Also, in some cases, there are software solutions available that can correct for certain types of non-compliance for Y2K. One Internet site to visit for a more complete discussion of this problem and a free test program is <http://www.righttime.com>.

The Software

OK, so lets assume our PCs are Y2K compliant. We ought to be home free, right? Wrong! Our software must also be Y2K compliant. Back when early software was being written, the ability to conserve memory was paramount. If you could find a way to store data in memory in a compressed way, you did it. It cost more processing time to compress and uncompress the data, but it saved memory. Memory cost more than processing time back then. One of the minor memory savings used was to store year values in two digits rather than four. In other words store 1985 as just 85. After all, everybody knew that the century value was 19 and it would be assumed that way by any software writer.

As a result, in many cases, only two digit year values are contained in the data input to date and time sensitive programs. One example of this is seen in the Keplerian element data. Remember the Epoch entry? It is in the form YYDDD.xxxxxxxx, where YY is the two digit year value. The satellite tracking programs written beginning in the middle to late 1980s have had to interface with these two digit year values. In many cases, the orbital calculation algorithms in these programs used the two digit year values throughout.

A typical tracking program looks at the Keplerian elements and then calculates forward from the Epoch time in the elements to the current time to determine the current position of the satellite. This means that the year, day and fraction of a day values in the Keplerian elements are the beginning point of the calculations. The current year, day and fraction of a day are the target of the calculations. The program must determine the exact difference in time from the Keplerian element Epoch time and the current time. This involves mathematical operations on the year, days, hours, minutes

seconds and fraction of seconds involved. Leap year days and Century days have to be accounted for also. This gets rather messy. So the Epoch times involved are converted to Julian days. Julian day one was January 1, 4713 BC. January 1, 2000 will be Julian day 2,451,545. There are mathematical formulas that let you input two different Gregorian calendar dates and times, with four digit year values, convert them to Julian dates and obtain the difference between the two dates in days and fractions of days. These formulas, take into consideration all leap year and century days. This really simplifies things. This difference in time is the input to the orbital calculation algorithms that let us determine the current satellite position from the Keplerian elements.

If there are tracking programs still out there which do not use Julian dates in their calculations, they are in deep trouble. However, even those programs that do use Julian date calculations can still have problems. Remember, that the Julian dates are calculated from Gregorian date inputs that contain a four-digit year value. NASA has said that the Keplerian Element format will remain the same and that the year value will just roll over from 99 to 00 with the transition to the year 2000. When the tracking program looks at the Keplerian elements for a satellite, how then will it know what century value to use with the two digit year value in the Epoch date? Somewhere along the calculation train, a decision must be made.

One way is to make the assumption, for example, that any Keplerian Epoch year value 78 through 99 has a century value of 19, and any year value 00 through 77 has a century value of 20. Once this has been done, the use of Julian day calculations will safely allow you track a satellite right through midnight December 31, 1999 into January 1, 2000 without a glitch.

However, there is another glitch to look for. In some orbital calculations it is necessary to calculate a value called the Sidereal Time value at January 1, YYYY at 00:00:00.000Z. This value is used throughout that year. Here again, the assumption above must be applied to determine which century should be applied to the two digit year value. In other orbital calculations, the Julian date difference between the Keplerian Epoch year value and the Julian day value for January 1, 2000 is used. Still, it is necessary to convert the two

digit Epoch year value to a four digit year value to obtain the Epoch Julian date.

Lastly, a less troublesome problem may arise when the Keplerian Elements are updated. Most tracking programs have a Keplerian update routine which protects against updating the elements for any given satellite with elements that are older than the ones already on file. Imagine what will happen when the first set of new Keplerian elements are issued in 2000. Some Epoch dates will have year values of 00 and some will still have 99. It usually takes one or two issues of Keplerian elements before all the satellites have a year value from the new year. In the case above, those satellites with Epoch year values of 99 will still update OK as long as the complete Epoch date is later than the ones already on file. However, unless some programming has been done to recognize 00 as representing 2000 and 99 as 1999, the 00 Epoch year elements will be rejected as being older than the ones already on file.

Some programs may permit updates overwriting existing elements without regard to the Epoch value. This will be the work around for those programs where the normal updates are rejected. Others which are not compliant in this regard may require that the Tracking program Keplerian data base file be deleted completely before each update until the new Keplerian element files contain satellites with all Epoch year values of 00. This will be done automatically in those programs which do not create a Keplerian element data base file and instead, just read in the distributed Keplerian Element file itself.

What Has Been Done

OK then, just what is the status of our AMSAT distributed tracking programs with respect to Y2K compliance? First, some background. Back in 1985 when I first changed the ORBITS programs from an interpreted Basic program to a compiled Quick Basic program I ran up against this Y2K consideration. I decided at that time I didn't want to hear from a lot of people in fifteen more years, much less pay the postage for replies, etc. So I made the decision to force the user to input the Epoch year in a complete four digit value separate from the Epoch day. I then tested the program across the 1999/2000 transition boundary and it worked as it should have. I was happy and confident that I would never have to worry with that problem again. Never say never!

Time went by and in 1994 I began making inquiries as to what NASA was going to do about the published Keplerian elements. Were they going to change the format of the Epoch day or were they just going to roll the year value over to zero (00). The answer I received was inconclusive. "We didn't know yet." At that time I also began making inquiries of a few of the AMSAT software authors as to whether their programs were Y2K compliant. I received some answers saying that it didn't appear so and a few that said yes. One said his program wasn't compliant and didn't expect it would be updated.

In June, 1996, I e-mailed as many of the software authors as I could find, asking them to make a Y2K compliance check of their programs and let me know what the status of the programs were, and whether or not they would be made compliant or not. My concern was that we should stop offering any programs that were not going to be made compliant. As a result of that inquiry we stopped offering one program. The author said that he did not intend to update it.

Then in October, 1997, at the AMSAT Symposium in Toronto, Philip Chien, KC4YER, and I met with Ken Ernandes and asked him if he could develop a set of test Keplerian elements for December, 1999 and January, 2000 that I could send to the software writers for their use in performing actual tests on their programs. He kindly agreed to do so and in a few weeks I received a TEST2000 zipped package via e-mail which I then sent to all the tracking software developers I could think of. Just for the fun of it, I decided to test the ORBITS programs again with the test Keplerian elements. It worked beautifully, tracking right up to midnight on the evening of December 31, 1999 and then into January 1, 2000 without a hitch. Then I tried to update the 1999 elements with the ones having 2000 as the Epoch year. Ugh!!! It refused to update, claiming the elements were older than the ones already in file. Back to the keyboard and compiler again. It had been so long since I had compiled a new version, I had a problem remembering how to get the compiler set up. I did get the fix in and it is now fully Y2K compliant....I think. Remember, "Never say never."

The replies began coming in following the Y2K tests and the results were as follows:

APRTRACK

This program was not Y2K compliant as of June, 1998. However the author has said that it will be brought into compliance and made available on the TAPR web site before 2000.

INSTANTTRACK

This program is not Y2K compliant through version 1.00b and earlier. However a patch will be made available for this popular program by mid-1999.

MACDOPPLER

This program is fully Y2K compliant according to the author.

NOVA FOR WINDOWS

Both the 16-bit and 32-bit versions are fully compliant according to the author.

ORBITS II & III

There is a problem updating the Keplerian elements in versions earlier than 5.01. This has been corrected in version 5.01. All other operations are OK. A work around for the problem in earlier versions is to delete the ELEM?.DAT files and recreate them anew with each update until all Epoch years in the elements are 2000. The program is ok after that until 2078.

QUIKTRAK

This program is not Y2K compliant and the author has said it will not be updated. The program is no longer being distributed by AMSAT.

SATELLITE PRO

This program is not Y2K compliant in versions issued earlier than June, 1998. The current version is Y2K compliant according to the author. Users having the earlier version will be able to download the required updated file later this year. The original KEPS LOADER, program written by a different author is not Y2K compliant. He has stated that it would not be made compliant.

SATSKED

No information available.

This program is fully Y2K compliant with versions 9748 and later according to the author. Updates are available from its web site. The older STSORBIT (not PLUS) program, version 9201, for older PCS has not been tested for Y2K compliance and there are no plans to update it at this time.

THE STATION PROGRAM

This program is fully Y2K compliant according to the author. Updates are available from its web site.

WINSAT

The current 16 bit WINSAT program is not Y2K compliant and will be replaced with a 32 bit version which will be compliant.

WISP16

This sixteen-bit version of WiSP may not be Y2K compliant. At any rate, it will not be updated. The program has been left on the AMSAT ftp site with the caveat that it may not be compliant and will be removed at a later date. This will allow the opportunity for Windows 3.1 users to become familiar with the program before being required to upgrade to WiSP32 for Windows 95/NT.

WISP32

This program appears to be fully Y2K compliant with version WiSP3210 and later. It will continue to be carried on the AMSAT ftp site.

Tracking hardware distributed at one time or another by AMSAT-NA:

KANSAS CITY TRACKER/TUNER

The KCT/T has no Y2K compliance concerns and is mentioned here only for the benefit of those users who may wonder.

SATTRACK III & IV

Y2K revisions to the firmware have recently been completed and tested and will be released to the owners shortly.

TRACK BOX

This unit is supposedly Y2K compliant from what I have been told, however no confirmation of this has been received from the persons responsible for firmware updates.

I suggest you visit some of the web sites listed in the resources below and find out more about the Y2K problem. You can also find other sites on the Internet by doing a search for the subject. Run the three simple tests to see if your PC will make the transition and if not, download a simple program to be run at boot time to see if that fixes the problem. There are such programs available on some of the Y2K web sites. Check with your PC manufacturer to see if there are ROM BIOS updates or boot time programs available for your PC that will fix the problem. After all is done, if your PC still fails Tests 1 and 2 above, you have the worst possible Y2K scenario. If you have date/time sensitive programs running on that PC, you should consider replacing it. If the PC fails Test 1 and passes Test 2, then at least you can manually set the date after booting it up. If it fails Test 3 however, there is no work around and all dates following February 29, 2000 will show the wrong day of the week. This may or may not be a problem for your particular applications.

Once you have run through the tests covered earlier in this paper, checked out your application programs and have satisfied yourself that all is well, then you should not have any further date/time problems, right? Remember, never say never. Those of you with some of the older GPS units, watch it on the evening of August 21, 1999 when the week counter rolls over from week 1023 to week 0. Also, watch out for the year 2038 when the signed long integer variable in the compiler that compiled your program is too small to contain the Julian date values. When this happens, I don't expect to still be around. However, I can look ahead and imagine that those who are, may wake in the middle of the night or look up from their work, depending on where they are, and wonder, "What was that"?

Sources:

Pete Woytovech, Senior Programmer Dell BIOS Development, *The Century Rollover and the PC System Date*, http://www.dell.com/r&d/vectors/v/v3_cent.htm.

RighTime (The RighTime Company, Miami), <http://www.righitime.com>.

J. David McLaughlin, Systems Coordinator Simco County Mental Health Education, *Testing Your PC's Hardware Year 2000 Readiness*, <http://www.mhcvn.ca/Y2K/pctests.htm>. ■

Home-Brew Ionosphere

Rick Fleeter, WA8VGK (rfleeter@mindspring.com)

During a three-day professional course I teach on minimum-cost spacecraft engineering, I use photos of several real micro and nanosatellites to illustrate approaches different groups and their missions have taken. A student will typically ask why the satellite has a certain shape, and the answer is usually that was the shape of the space the launch accommodation provided - as if the satellites were a mold of the launcher envelope. The functionality, cost and complexity of our satellites are molded the same way - they are the image of what we expect out of a mission, what technologies we happen to be interested in when the design freezes and our mental model of the user we are catering to.

Today's commercial-spacecraft user is different from that of 20 or 30 years ago, hence the emphasis on LEO satellites that can service users on the go with handheld cellular phone-like handsets. Nowadays a fixed installation is not a big operations building flanked by 18' parabolas, but rather a parked RV with an 18" dish for receiving television and audio entertainment, and maybe Internet pages. A growth area in satellites is very simple devices built by and for college students to experiment with aerospace engineering, space science and space communications. These satellites are simple and are conceived, designed, built and flown in less time than it takes to get a Bachelor's degree. The trick isn't that these college students are smarter than Hughes in building satellites cheaply and quickly - they are responding to a differently shaped *mold* of what they expect from the mission.

Amateur Radio has a lot in common with my company's commercial and academic satellite customers. Thirty years ago, mobile operations required installation of hefty power inverters and mechanical mounting of rigs weighing twenty or more pounds, dissipating hundreds, if not a thousand watts. Not so today, when mobile operation can be as simple as putting the HT on the dashboard or passenger seat, or plugging a more powerful UHF, VHF or even HF mobile rig into a cigarette lighter and snapping a magnetic mount antenna on the roof. And frequent laments in *QST* notwithstanding, the hams I know enjoy getting a little deeper into radio than buying a rig and plugging it in - assuming the technology isn't too daunting.

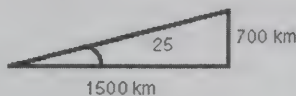
Thus after 35 years in Amateur Radio, almost 20 years volunteering off and on with AMSAT, and twelve years paying a mortgage by working in microsatellites in the private sector, I watch AMSAT's current initiatives a bit bemused. Here the world has discovered small, simple, highly functional, rapidly built, cheap and basically fun microsatellites, which AMSAT arguably popularized, while AMSAT is committed to ever larger and more complex satellites that only the smallest fraction of its membership will ever understand. Phase 3D also ignores the burgeoning market of amateurs, like me, whose best operating opportunities are when we're strapped into cars, on travel operating from hotel rooms and otherwise separated from home, 110 VAC, reasonable antennas, rotors and possibly even hardware to run tracking software.

Amateur Radio of 1999 is dominated by HT and other VHF / UHF users - maybe because licensing is easier, but more likely because (a) you can usually actually reach somebody and talk with them with virtually no QRM, and (b) you can hold the requisite hardware in your hand and stuff it in a briefcase or backpack or jacket pocket for storage.

What a wonderful opportunity we've got. All these users out there with HTs, many of which work not just 2 meters, but also 432

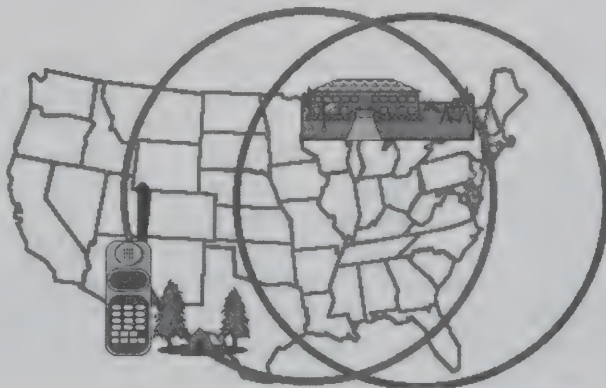
MHz, the two best ham bands for satellite work and for HT gear. And who can these 100,000 or so HT users talk to right now? Anybody they want to, so long as they both are within a few miles of a repeater. What 432 and 2 meters lack is a synthetic ionosphere, one that works on VHF and UHF, preferably, that we can access and do some real DXing and just plain band fishing for new contacts outside our local repeater. Not that those same guys we meet during every morning and evening commute aren't great company, compared with Howard Stern and NPR on the FM, but wouldn't it be neat to get on a satellite from an HT in your car and pick up an evening commuter outside London while you drive back from the office in Boston - or a friend in Hawaii on her lunch break while you drive home out the 405 to the LA's San Fernando Valley? And all this without ever loading ephemerides into a satellite tracking program, without pointing stacked Yagis or even an Arrow antenna at a satellite, and with just the few watts your handheld puts out on its built in NiCads?

Impossible? Is there some reason every Little and Big LEO constellation can do this, using technology we hams pioneered, and meanwhile to get into our own satellites you need a degree in engineering, a roof or backyard stacked thick with microwave



CLUSTER OF SATELLITES NOMINAL 700 KM ALTITUDE

- Footprint 3000 km diameter
-> lots of overlap likely
- Link to handi-talkie @ 144 or 432 MHz



antennas and a schedule which can be built around when the satellite is *up* (above the horizon)? Imagine if your local repeater required all that planning and gear, or was mainly devoted to passing digital messages instead of natural voice - I bet the ARRL repeater guide would be printed on one sheet of paper - as can the list of all the current ham satellites.

It gets back to satellites reflecting what we want them to be. Until today, Amateur Radio satellites have been cutting edge technology platforms for the few of us who are serious enough about satellites to get elbow deep into their design and construction, or equally deep into building their ground stations. They are certainly something we can all be proud of. I'm among those who think the microsatellite revolution we're all experiencing was catalyzed by Amateur Radio - and that's part of our charter and mission as hams. But we also need to use the spectrum that has been entrusted to us, interest ourselves in using our radios, and popularize our hobby so that our numbers go up and the average age of hams goes down. And of course having a highly robust satellite communications system deployed, that hundreds of thousands of hams worldwide can access from battery powered gear is not going to hamper the emergency and community services aspects of ham radio either! While 20 or 15 meters can let you down just when you critically need that long haul link - or the antenna can get blown down, our synthetic VHF/UHF ionosphere, created by clusters of satellites repeating back to earth what they hear on segments of those bands, will be there and accessible reliably and virtually continuously.

It seems easier to talk in these sweeping generalities of wondrous capabilities, of a nearly perfect worldwide communication system, than to realize them in hardware and software. But the realization is the result of visualization - start with what we as the amateur community want, then challenge ourselves technically and organizationally to build a technology that will help our hobby. We can do almost anything we can dream of - *but first we need the dream.*

But how would we realize this sort of capability? One important advantage of Low Earth Orbiting satellites using 2 meter and 432 MHz is that with fairly simple on-board antennas and very coarse satellite pointing we can get a solid link to a low gain, low power (ie HT) station on the ground. At higher frequencies, the antennas get too

small, and gain antennas are required, and at lower frequencies, the rigs get to big, and the ionosphere too opaque, though 6 meters is also a possibility.

So we need a repeater, with maybe 2 or 5 or 10 watts of RF power, in LEO? Not, as the Avis commercial says, exactly. A single LEO satellite sees about two percent of the Earth at a time - so you need 50 of them to be able to have access anyplace, anytime. And in order to keep the satellites evenly spaced in equally spread (optimal) orbits requires lots of money for custom launches and on-board orbit maintenance propulsion. At least this is the model of the commercial LEOs which are flown in fixed *constellations*, so - called because propulsion and sophisticated navigation is used to precisely spread the satellites around their orbit planes.

An alternative is *satellite clusters*, so-called because the strategy is to launch a lot of satellites, many more than the optimal number, and let them wander randomly. This is how we make cookie dough - we don't precisely arrange sugar crystals and flour particles to ensure an even mixture - we have millions of each and by stirring achieve a random, and given the high numbers, highly uniform, mixture. Millions of satellites is for now left to science fiction but a factor of 2 times more satellites randomly distributed will give about the same coverage as a tightly maintained constellation. Clusters assume the satellites are cheap, while the launch is expensive, which is a good model of small ham radio satellites - we can build the satellites ourselves, but launching them still requires plenty of jawboning and even considerable dollars spent on the operators of large launch vehicles like Ariane, Delta, and Start.

Clusters take advantage of another aspect of ham radio. Not being network TV nor a telephone company, if there is a gap of a few minutes in coverage once or twice a day, we don't get hauled into a meeting to explain ourselves to a room full of upper managers, lose advertising revenue or get fired. As the cluster population grows, outages become rarer and in fact the opposite occurs - at most latitudes several satellite *repeaters* are in view of most ground stations.

We are used to this, those of us who have spent many a solar cycle on HF. The result is on the one hand QRM but on the other hand, lots of coverage for you and more DX opportunities. As traffic becomes an issue,

subsequent satellites can be built to use different band segments. But imagine what a great problem this is - overcrowding 432 MHz. The boon to Ham Radio would be enormous - we don't go to the FCC to defend our underused allocations - instead, we go asking for more spectrum as more hams come on-line and all of us use our radios more. *That's the kind of problem we all need!*

Analogous to HF, you might want to tune your radio around to a couple of different frequencies as there might be less QRM on one satellite band than another, or, due to satellite location, a different set of QTHs accessible. But even with only one satellite nearly straight overhead, so that you are in the center of its range, your radius of propagation is close to 1000 miles - that means for Midwesterners, coverage of both coasts and every place in between. For East Coasters, a satellite passing over the North Atlantic brings in European and Russian DX, as well as your kid 200 miles away at Down State U. West Coasters will have great *skip* into Alaska and Hawaii and opportunities into Japan and northeast Asia - depending on satellite orbit altitudes and where they are in their pass. But again, as the cluster population grows, these opportunities will quickly become almost continuous - more analogous to a very large repeater network than to the vagaries of HF - and still, all from an HT with no more than a decent 1/4 or 5/8 wave whip.

Another exciting aspect of a cluster of simple and inexpensive Amateur Radio satellites is how to build and launch them. Simple linear transponders operating at a single radio frequency band from LEO do not require large, nor complex, nor expensive spacecraft. AMSAT can prototype a few, and then make plans and even parts kits available to individual hams and ham clubs. Do it yourself satellite construction - a new frontier brought to the world by Amateur Radio. Fantastic!

But how to get them launched? Every amateur radio satellite launch is a negotiation - an exercise in jawbone diplomacy, begging and shopping. But our cluster has several important attributes. Each satellite is tiny - probably under 10 kg (22 pounds) and about the size of an HF mobile rig like my Alinco DX-70T or an ICOM 706. This makes piggybacking relatively painless for large launch vehicles - we fit in space they don't care much about. Second, we don't care what orbit we go to.

The cluster is random - the more randomness the better. Some of us might get launched from the Hitchhiker accommodation on Shuttle, some will go as piggybacks on Ariane and Delta, some might get thrown out of a Space Station airlock (*Mir* does this), and others might ride with science and commercial satellite launches from Pegasus, or in Russia or China. Many hams have connections to various space activities, and once we establish a launch on a new rocket, we can keep repeating the process whenever a few more copies are ready to fly. Our satellites are prime piggyback launch candidates – pre-qualified for safety, very small, and not at all particular about the orbit they go to.

Since we're flying lots of satellites, we can accept lots of failures. Thus we won't plan to baby these satellites, checking them over and over up 'till the moment of launch. They should be designed to ship in a box so that one person can open the box, fix it to the launch vehicle and leave. Maybe no ham

needs to go to the launch site - just ship it to the on-site technical staff, since they will have seen other nearly identical satellites before. Build-your-own kits have the advantage that we do not need to go through the complex, costly and time consuming tests normally afforded one-of-a-kind satellites. Once the first few are type-accepted, we can inspect to ensure that nothing is going to come loose, and launch when ready.

With just a few satellites in, say, Shuttle orbit, we'd begin to have many periods per day of good coverage. With several tens of satellites, we'd have better than 50 percent coverage – i.e. you could key the mike and hear yourself, just as we do with repeaters - and get into the satellite 50 percent of the time. By the time 100 satellites are up there, not a lot given the number of ham groups around the world that could build these rigs, coverage would be universal - the satellite might not be where you want it for long *skip* but you'll always have coverage for

hundreds of miles around you, with frequent DX openings. As the number grows to several hundred, you would have nearly continuous local and DX opportunities - talking to stations over a thousand miles away with FM clarity from an HT in your car would be a mundane reality, just as jumping on the local repeater is today.

Hams like me who travel a lot can pack just an HT, magnetic mounted antenna and a cigarette lighter plug and stay in touch with the home QTH, and the local club. The operating possibilities, including DXpeditions and contests, besides just keeping in touch and having a lot of fun, are limitless, and the fun of building the little things and hearing *your* satellite calling you back (each satellite would have it's own signature ID reflecting the group that built it) would infect a new population of hams, and rekindle the excitement of us old timers.

Next time - some design elements for the home brew ionosphere. ■

Satellite Orbital Elements

by Ray Hoad, WA5QGD

Satellite	AO-10	AO-27	FO-20	FO-29	RS-12/13	RS-15	RS-16	MIR
Catalog Number	14129	22825	20480	24278	21089	23439	24744	16609
Epoch Time	99011.95911000	99014.74597407	99014.12199225	99013.98865588	99014.04809357	99014.22581851	99014.24026073	99014.79368366
Element Set	4	695	122	223	134	362	372	117
Inclination	27.1123	98.4776	99.0387	98.5415	82.9252	64.8276	97.2406	51.6598
RA of Node	48.7076	84.1183	238.0737	345.9074	211.5643	301.3844	280.6077	49.3217
Eccentricity	0.6010746	0.000865	0.0541596	0.035233	0.0030073	0.0152831	0.0004893	0.0010012
Arg of Perigee	281.7573	358.4125	153.6477	133.5006	131.7424	20.9582	154.2697	357.3657
Mean Anomaly	69.6767	1.7026	209.328	229.5998	228.631	339.7515	205.8789	2.7272
Mean Motion	2.05864167	14.27843995	12.83247638	13.52656241	13.74118350	11.27533168	15.45500106	15.70659228
Decay Rate	0	0.00000068	-0.00000105	-0.00000013	0.00000053	-0.00000009	0.00022312	0.00025128
Epoch Rev	11717	27634	41857	11896	39824	16688	10449	73727
Satellite	UO-11	UO-14	AO-16	DO-17	WO-18	LO-19	UO-22	ISS
Catalog Number	14781	20437	20439	20440	20441	20442	21575	25544
Epoch Time	99013.92220920	99014.22686086	99014.22386319	99014.22112214	99014.23372860	99014.78235770	99014.16904037	99014.81510969
Element Set	136	446	207	221	221	206	916	218
Inclination	97.9087	98.47	98.4979	98.5046	98.503	98.5083	98.2202	51.5917
RA of Node	344.7455	91.9376	96.4036	97.7465	97.5734	99.1627	61.7403	248.8989
Eccentricity	0.0011243	0.0011034	0.0011521	0.0011169	0.0011984	0.0012293	0.0008135	0.0004099
Arg of Perigee	329.3987	315.6067	318.6284	315.9655	317.083	313.8915	332.4913	18.8047
Mean Anomaly	30.6544	44.4225	41.4022	44.0651	42.941	46.1251	27.5841	341.3047
Mean Motion	14.70144625	14.30102746	14.30141059	14.30292733	14.3024819	14.30373513	14.37243433	15.56509711
Decay Rate	0.000000844	0.00000132	0.00000087	0.00000112	0.00000091	0.00000132	0.00000176	0.00007267
Epoch Rev	79582	46854	46856	46860	46860	46871	39321	867
Satellite	KO-23	KO-25	IO-26	TO-31	GO-32	SO-33	PO-34	Phase 3D (est)
Catalog Number	22077	22828	22826	25396	25397	25509	25520	99934
Epoch Time	99014.10277815	99014.21204503	99014.24865984	99014.22162314	99014.23301842	99014.17051034	98344.82322241	96260.25523447
Element Set	823	677	708	106	122	72	28	3
Inclination	66.0812	98.4784	98.4839	98.7753	98.7775	31.4419	28.4605	60.0203
RA of Node	19.3815	84.139	84.0582	88.6281	88.6045	296.7806	243.1275	342.7876
Eccentricity	0.0015514	0.0010166	0.0010463	0.0003511	0.000174	0.0369264	0.0007937	0.6752895
Arg of Perigee	258.8247	339.2805	355.9508	142.5294	129.3293	238.5641	107.9932	180.1221
Mean Anomaly	101.1026	20.796	4.1585	217.6132	230.8039	117.8376	252.2034	179.5089
Mean Motion	12.86317236	14.28322133	14.27961090	14.22317735	14.22213721	14.23787576	15.03095972	1.51063968
Decay Rate	-0.00000037	0.00000121	0.00000055	-0.00000044	-0.00000044	0.00000282	0.00002066	0.00002
Epoch Rev	30182	24443	27629	2673	2675	1164	633	2

Field Ops Update: Recognition

Barry A. Baines, WD4ASW(wd4asw@amsat.org)

Each year during the AMSAT Symposium Banquet, we take time to recognize individuals who have made a significant contribution for AMSAT. At the 1998 Symposium in Vicksburg, Field Operations highlighted seven AMSAT members who have made a difference for AMSAT. Their accomplishments deserve not only recognition at the banquet, but by taking this opportunity to highlight their successes, it provides a mechanism to encourage our membership to identify ways that they may also make a difference in their respective communities on behalf of the Amateur Radio satellite program.

Field Ops personnel do not have a specific *job description*. Each volunteer's level of involvement is based upon their own determination of how much time is available as well as their area of expertise and interest. Indeed, this diversity in how our AMSAT members contribute to field activities was highlighted at Vicksburg. These individuals and their citations are listed below.

Steve Bible, N7HPR: For your masterful introduction to WiSP, including installation and setup, for incorporation into the *Digital Satellite Guide*. Your attention to detail and insistence on anticipating questions and providing comprehensive information has resulted in reviving the *Digital Satellite Guide* and making it a publication which meets the needs of today's digital satellite operator.

In addition, your enthusiastic participation in the AMSAT/ARRL Satellite Workshop in Orlando enhanced the value of the workshop and made it possible for participants to develop a solid understanding of the role of digital satellites.

Larry Brown, NW7N

For your extensive coverage of the Southwest on behalf of AMSAT. You volunteered to work several hamfests this year as well as made an outstanding contribution as an instructor at the AMSAT/ARRL Workshop in San Diego.

Also, for stepping forth and providing valuable assistance to the operation of the HF nets at times of need.

Your enthusiasm and willingness to represent AMSAT enhanced our educational efforts throughout the Southwest and resulted in very favorable comments from those that benefited from your participation in these various events.

Keith Pugh, W5IU

For your continuing strong support of Field Operations. As in prior years, your tireless efforts at the Dayton Hamvention included assistance with setup and take down and numerous hours at the booth itself demonstrating software and dealing with the myriad of questions from attendees.

Your leadership at HamCom has resulted in a significant AMSAT presence at this major event, which not only meant running the booth, but also included participating in forums.

Your assistance with the AMSAT/ARRL Satellite Workshop in Orlando contributed markedly to the success of that important activity. Also, your help at Baton Rouge was key to the positive outcome of that event.

In addition, your recent activities with education involving young children is in the best interest of AMSAT.

Bob Carpenter, W3OTC

For your dedicated support of AMSAT activities at the Dayton Hamvention throughout the years. You have consistently volunteered to serve at the Hamvention, transporting the office computer between Silver Spring and Dayton each year, and handled a variety of membership and support tasks during the entire Hamvention.

Your willingness to spend considerable time each year at the Hamvention responding to queries, demonstrating software, and assisting with setup has made a significant contribution to the overall success of AMSAT at the largest hamfest in the US.

Mike Seguin, N1JEZ

For your extensive efforts to encourage newcomers to get involved with amateur radio satellites. Your updated *Amateur Satellite Resource Guide* is given to new AMSAT

members as well as being available on the AMSAT web page. You also updated *Working the Easy Sats* which is a very popular publication offered through AMSAT. Your extensive demonstrations of amateur satellites at hamfests, such as Charlotte, VT, as well as participation with Field Day has enhanced the popularity of amateur satellites in Vermont and elsewhere.

Many thanks for your willingness to support the amateur satellite program through your 'hands on' involvement.

G. Gould Smith, WA4SXM

For your rewrite of the *RS Operating Guide*, adding a comprehensive discussion of five additional satellites as well as updating information on the RS birds themselves. Your extensive work resulted in a new publication, *Analog Satellites Operating Guide*. As a result, AMSAT now has a thorough publication that will help new satellite operators successfully communicate through these satellites as well as generate needed revenue for the organization.

Just as impressive, you drove from Knoxville, TN to Dayton for the express purpose of delivering printed copies of the new book directly to the AMSAT booth at the Dayton Hamvention in order to make it available during the biggest hamfest of the year. Many thanks for your continuing efforts to educate satellite users on how to utilize these satellites.

Howard Ziserman, WA3GOV

For your pervasive support of AMSAT throughout the year. No one has covered more hamfests than you have. Your dedication is reflected in the many miles driven to represent AMSAT at hamfests around the Mid-Atlantic Region.

In addition, you saved AMSAT considerable shipping expense by driving AMSAT materials between Silver Spring, MD and the Dayton Hamvention. During the Hamvention itself, you spent an extensive period of time serving at the AMSAT Booth handling a myriad of tasks.

The time that you have spent throughout the year in support of AMSAT activities has been impressive. Your recent move to Oklahoma

has left a 'void' that will be difficult to fill in the Mid-Atlantic Region.

What lessons can we learn from these successes? These accomplishments highlighted this year can be divided into several categories: hamfest activities (such as Dayton and Hamcon), teaching (Satellite Workshops, working with youth), demonstrating amateur space communications (such as AO-27), and distributing information helpful to newcomers (the various guides). In each case, our volunteers gladly shared their knowledge as well as their time. Each person touched many people by the various ways they reached out to others. Our recipients also presented themselves (and AMSAT) in a highly professional manner, which left a very positive impression on everyone they worked with. Their openness and enthusiasm directly translated into building support for AMSAT.

Hopefully, the outstanding accomplishments of these individuals will serve as examples to our membership and help to motivate us to find ways that we can make a difference in our respective communities. While not everyone may be in position to teach a workshop or write a book, there are a number of activities that our members may want to consider doing:

- Writing an amateur satellite column in the local club newsletter
- Giving a satellite presentation for beginners at a club meeting (Materials are available from the AMSAT web site)
- Volunteering to give a forum at a local hamfest
- Establishing an AMSAT net on a local repeater
- Organizing a local AMSAT meeting
- Encouraging newcomers to try space communications by demonstrating AO-27 or other 'Easy Sats'

Of course, while we celebrate the accomplishments of these recipients, we also realize that we may have overlooked other individuals who are deserving of recognition as well. Your efforts towards building greater support and enthusiasm for the amateur satellite program are certainly appreciated. ■

An Invitation to AMSAT-NA's 30th Anniversary Party

In March 1969, AMSAT was incorporated by Washington, DC area hams.

You're invited to AMSAT's 30th Anniversary Party at the NASA Goddard Employees' Recreation Center, Greenbelt, MD, at 6:00 pm, Saturday, March 13, 1999.

Directions will be posted on the AMSAT web page, or call Martha at the AMSAT Office at telephone 301-589-6062 or fax 301-608-3410

I know I can't get in unless you have my money in advance! Here's the \$12 per person for the party and steak dinner.

Number of Participants..... Amount sent: US\$

Print Name Call

Print Address

City..... State..... Zip Code.....

VISA/MasterCard Exp.....

Daytime telephone number

E-mail address.....

Make checks payable to: AMSAT and send to: AMSAT-NA, Suite 600, 850 Sligo Avenue, Silver Spring, MD 20910-4730

Please respond no later than March 5, 1999.

— No AMSAT funds will be used for the celebration —

Make a Full Day of Your AMSAT-NA 30th Anniversary Visit!

While you are in the Greenbelt area for the 30th AMSAT Anniversary Gala, ***why not come early*** and get the full experience of NASA's Goddard Space Flight Center's on-going scientific, engineering, and Amateur Radio endeavors? Some of the tentative activities planned for the day include tours of:

- ___ Hubble Space Telescope Control Center (Limited Viewing)
- ___ Goddard Spacecraft Environmental Test Facility (Where many OSCAR satellites were tested.)
- ___ NASA Communications Network (Where all NASA's historic human spaceflight communications were coordinated.)
- ___ Goddard Amateur Radio Club Shuttle Retransmission Facility
- ___ GSFC Visitors Center & Museum (FYI, the old AMSAT-Lab *Fishbowl* is still standing.) Buy some space-related gifts at the Gift Shop—open from 9 am - 4 pm

When preparing your registration form, please number in order of interest the tours that you would like to take. After March 5th, Martha will announce the times of the tour schedule via amsat-bb.

Yet Another Microwave Signal: YAMS (Not the Fruits)

John Hackett, LA2QAA (la2qaa@amsat.org)

This article describes an easy to build signal source for those operators who are setting up their stations for Phase 3D's Mode S.

Other signal sources have been published and they usually use components that need to be ordered specifically for the job at hand. This signal generator uses components found in most Amateur Radio operator's junk boxes.

The oscillator itself is a standard design using a Butler-type oscillator followed by a diode multiplier and tuned circuit. The Butler oscillator generates a useful 16mW which is fed to a Shottky diode generating a lot of harmonics. The frequency of interest is selected by the tuned circuit.

Standard microwave construction practice is used; passive components on one side of a double-sided fiberglass PCB with the transistors and tracks on the other side. The topside is a complete groundplane with 1mm holes for the component leads countersunk with a blunt 3.5mm bore (blunt, so the *gorilla types* don't bore right through the board).

Note that the grounded ends of the components are soldered to the topside groundplane only (you'll see why later).

The 2.4GHz stripline filter is also on the topside in a shielded compartment.

The stripline is made from brass sheet, bent at the ends and soldered centrally in the compartment with both ends soldered to the groundplane. The stripline is tuned by a piston trimmer. The output stripline is bent at **one end only** and soldered to the groundplane.

Note that the BNC output is connected **DIRECTLY** to the output strip.

Leads must be as short as possible.

The figures and photo should be self explanatory.

The PCB measures 105 x 75mm and is double sided fiberglass board with etched tracks and a part groundplane round the perimeter of the underside and a complete groundplane on the topside.

The enclosure is made from 0.8mm copper sheet 30mm in width and soldered all the way round the PCB on both sides, ensuring a good ground. (Now you know why the grounded ends of components are soldered on the topside only.)

Note that the PCB is not mounted at the *center* of the sides but nearer the bottom. This allows the aluminium core to protrude from L1 without detuning the circuit. It also ensures the stripline is not detuned by the lid.

The lids of the *box* are made from 0.3mm copper sheet *fingered* with a pair of scissors round the bent down edges to ensure an RF tight fit. The feedthrough caps for the diode bias test point and +12v line protrude through the copper walls and are soldered on both sides.

Screw in and bolt feedthroughs can also be used but they're more expensive.

I used BFR 34A transistors simply because they were in my junkbox. They are probably now obsolete (like LA2QAA!). They could be replaced by BFR 91's or any equivalent.

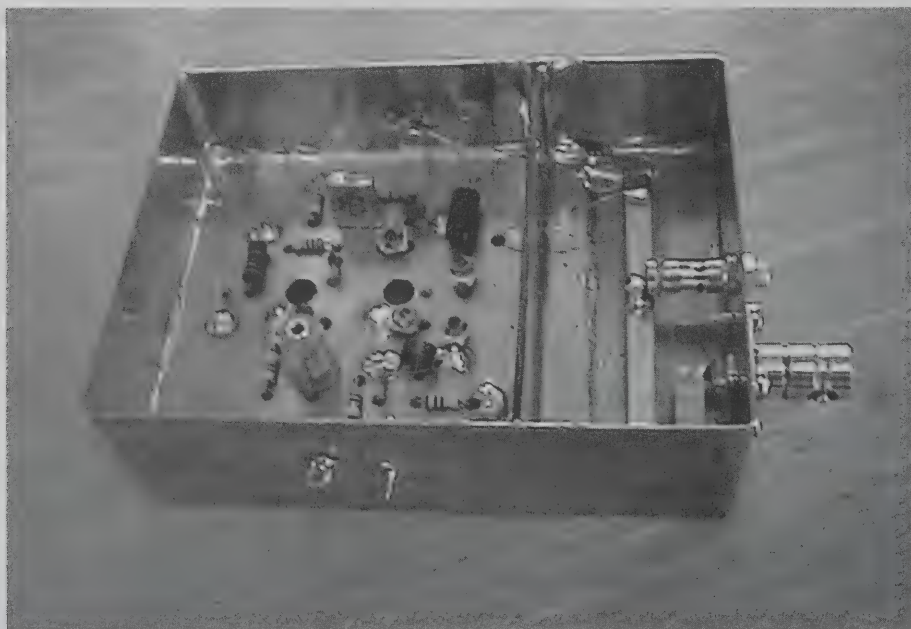
Don't forget the shield between the oscillator and the filter. A quick check of the measurements will show that the *simple* filter is in fact an offset cavity type. (35 x 35mm).

(Yes, some thought did actually go into this project).

Setting Up

Loosely couple your frequency counter to L1 with a piece of insulated wire *stuck down the slug* (highly technical) or use a cheap FM receiver tuned to 96 MHz. Tune the slug and/or C6 (the 003 ensures you will be just up from the band edge on 2.4GHz). Tune C9/C10/L2 using a diode probe for max: RF (between 15 and 18mW). Temporarily short circuit the RFC with a wire from C14 to ground. Check the diode current. When satisfied, remove the link. Next turn on your 70cm transmitter and tune around 432.075MHz to test the output. (This will output in the region of 2400.050 to 2400.100.) Your signal source is now set up. You can listen to the signal at 2.4GHz and tune C15 for *maximum smoke*.

Grateful thanks to GM1SXX (he knows why and *you don't need to know*).



Front view of YAMS (photo by LA2QAA)

Observations from Norway

The Secret is Out

John, G7HIA, reports that LA2QAA's *secret* is not a secret anymore. He has been informed by a reliable source that the *expatriate* has been using a linear amplifier with a power of 25 watts on FO-20! Reputedly a dyed in the wool *enough power to do the job* operator, LA2QAA has been caught talking to Terry G1WPR using a power well in excess of his normal 5 watts. A suitable punishment was devised by Terry who *blabbed* the secret to the AMSAT-UK net. LA2QAA was last heard muttering the "excuse"...."Yes, but I only use it when people complain of QSBand....I'll get you for this mate. G7NFO the other half of the *FO-20 twins* refused to comment.

A Change of Habit

I can say that my *operating habits* have changed of late. I've been spending my time collaborating with GM1SXX developing a cheap alternative to the commercial 1.3GHz transmit modules found in some *expensive* Amateur Radio equipment. Al and I hope to be able to produce a booklet (*Microwaves for Dogs*) in the not too distant future that will help the newcomer to microwaves become QRV on Phase 3D without having to sell the house, car, XYL (and/or her jewelry). The design criterion has been for an *inexpensive and easily reproducible* transmitter using *off the shelf* components. (The impossible dream.....G6ZRU). We hope to be able to dispel some of the *myths* of *the black art*. The book will be pretty much the same format as the previous "DOGS" book: *The Beginner's Guide to Amateur Satellites*.

DOGS 2 will contain a lot of construction articles as well as the usual *waffle* on antennas, operating procedures, frequency lists, glossary, and etc. It is hoped that the booklet will encourage a lot of satellite operators unfamiliar with the higher bands to *have a go at something different*. Using modern components it is in fact easier to build microwave gear than the old HF stuff.

Deck Chairs?

Another reliable source who asks to remain anonymous, when queried why a certain well known *RUGBY* based station has apparently *disappeared* from FO-20 of late informs *Observations* that the aforementioned station's proprietor has rented a permanent

YAMS Components

R7	10 ohm.
R8	330 ohm.
R3 R5	470 ohm.
R2	680 ohm.
R1. R4. R6.	1K.
C8	22p ceramic.
C3	27p ceramic.
C1, C2, C5, C7.	1000p ceramic.
C15	6p piston trimmer.
C4, C6, C9, C10, C11.	10p miniature ceramic trimmers.

C9 + C10 = 5p (I didn't have a 5p trimmer in my junkbox)

My trimmers were culled from an old 70cm rig.

L1	4.5t GREEN Toko VHF coil with aluminium core.
L2. bit.	5t 5mm O.D enamelled copper wire close wound on 5mm drill bit.
X-tal.	96MHz.
RFC.	5t on a small ferrite bead.

deck chair on Bournemouth PierI see no ships...only hardships!"

Having returned to the fold (FO-20/FO-29) after my period of dabbling in the black art, I find, had it not been for my anonymous friend that I would have been talking to myself! (Or heading for Bournemouth Pier.) Activity it seems to have waned even more in the last few weeks.

same direction when they reach the grounded part of the circuit? No chance! They take one look at that wall and say "sod this, I'm off down that capacitor lead!"

NB: Take it from me, "electrons" are blessed with a bone idle nature. (Aye! Like *certain* stations in Norway...G7NFO) unless they are *prodded* with a few volts of electricity up their molecules!.....LA2QAA.

Explanation

I was asked recently for a *non-technical* explanation of why "electrons" don't like 90 degree bends or shields.

After the little buggers have *dashed* down the entire length of a stripline they are so *fagged out* they simply don't have the inertia to start climbing walls! Consider the *size* of an electron; imagine you are one! Now consider a 20mm high wall right in front of your nose after a mad dash down the aforementioned stripline. Would *you* climb it?

It's more sensible to take the *easy* way and just wander off down through the capacitor. Remember, the little sods are *knackered* after their *sprint* along the stripline. Do you seriously think they would carry on in the

Marigolds

Satellite operators are not renowned for their *washing up* abilities, particularly when there's a workable **FO-20** "pass" imminent. However, some operators go to *extreme* to get out of a simple *chore*. It has come to the attention of the *Observations* editorial staff that a *certain* well known and highly respected operator who, for the sake of future world peace must remain anonymous when requested to *do the dishes* instead of acquiring a pair of *Marigolds* (rubber gloves for our American friends) and a bottle of lemon flavored *Fairy Liquid* (which goes twice! as far as the competition) according to the fairies whizzed off and purchased the most *expensive* household apparatus (a dishwasher) money could buy. Thereby, LA2QAA and G7NFO have now lost their joint world record for *bone*

idle satellite operators. The *chortling* sounds on FO-20's downlink this morning (14NOV98) were traced to the Rugby, UK area. G7HIA, the illustrious AMSAT-UK net controller is reported to have commented: "Gentlemen, this frivolity must cease forthwith"! The previously mentioned *anonymous* station will no doubt reply to these allegations on the next pass. Meanwhile, a certain station in Norway has learned his lesson and relegated the offending 25w amplifier and instigator of the above tirade to the *recycled components* bin. LA2QAA and G7NFO have each donated a yellow *marigold* to a certain deserving AMSAT member to be used just after his Christmas feast.

FO-20

FO-20 is back in the *stateside QSO's* part of it's cycle again with strong signals from the Michigan area. Nice to work me' mate Jim W8VXH again. I think Jim must suffer from insomnia because he's always up before the birds.

White Stuff

The white stuff (snow) is still descending from on high. The Norwegians of course are rejoicing, skidding around all over the place with oversized toothpicks strapped to their feet. Personally, I cannot abide the stuff. Some may think it's picturesque but after shovelling

meters of the stuff from October to March I'm of a slightly different opinion.

2411980905Z

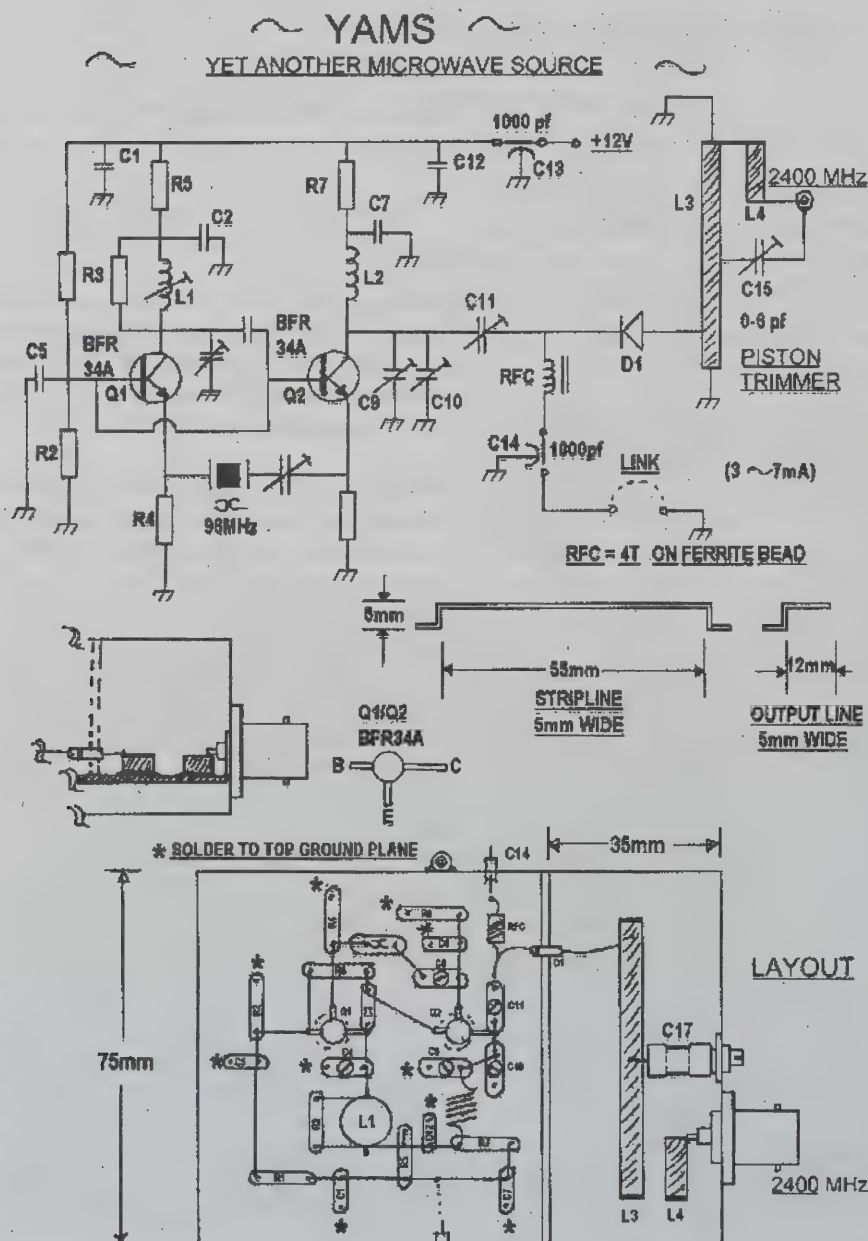
As is well known, FO-20's beacon has been below par for quite some time now. However it has been sending a carrier so it's still possible to listen to the beacon before moving up for a QSO. (If you don't know why you should listen to the beacon first, *take the time to find out!*) This morning I was quite surprised to *not* hear the familiar carrier but a weak and warbling raspy sound (something like PSK). My first thought was maybe it had been hit by a meteor. But when I tuned up the passband I had a pleasant QSO with me' mate Deiter DH1RSR with S9 at both ends. After the QSO I went back to the beacon frequency to find it was still *watery* and *rasping*. (Probably got Bronchitis!.....G7NFO). It may be a case of *old age* or *just the propagation*. Anyway, it reminded me what a sad day it will be for the amateur satellite fraternity when FO-20 finally *throws in the towel*. As I've mentioned before, all credit to the design team and all involved. May FO-20 continue to serve us for a *long* time to come.

Four Days Later

Further to the above. This morning (2811981025Z) VE3KNG was attempting to work some Europeans but was having difficulty due to the *QRM* and the extreme high power of several stations. (*What did you say full duplex meant?*) One comment I particularly liked was "I'm only using 100 watts." Anyway, Jim asked the stations concerned to try again later. I hopped in with my 5 watts and we had a pleasant chat. I think the *thought for the day* was "use an antenna!"

As is my wont, I listened to the beacon before going upband for a QSO. It sounded to me like the raspy carrier has disintegrated even more in the last four days. Therefore, I suggest we all *hit* FO-20 with as much power as possible (using non-resonant wire coathangers for antennas) so we can knock it on the head and be done with it. I'm sure that G7NFO, G7HIA, DH1RSR, G1WPR, W8VXH, OZ1MY, DL6YBD and the other *regulars* will all agree that using sensible amounts of power and *antennas* (God forbid) is just prolonging FO-20's agony.

NB. For those not familiar with Manchester humor, the previous lines *were* written with tongue in cheek. Must check my dictionary to find out what *full duplex* means.



The Concise Mongolian/English Dictionary

FULL DUPLEX: A term used in satellite communications meaning: If you can hear your own downlink and you can also hear another station using the frequency, immediately disconnect receive antenna then increase power until *no-one* can use the frequency.

Ground Gain

One may recall I previously mentioned that there wasn't a *brick wall* round the perimeter of the range circle and that with decent antennas one could often hear the satellite after it had passed out of the range circle. This morning, I worked Jim VE3KNG again with excellent signals on FO-20 as the satellite passed over Greenland. Just prior to our QSO Jim was picking up Europeans in their *millions* and he mentioned he was firing at the satellite at zero degrees elevation. The phenomena *ground gain* is one often experienced on 70cm polar links between this QTH and Alaska. When Jim mentioned to a G6 that he was below zero degrees I could still hear him at S9 (genuine report) so gave him a call. He came right back with an S8 and we had a two minute chat with elevations of *below zero* and *three degrees* respectively.

For those looking for *interesting* QSO's, when your elevation is below five degrees, don't just switch off. Have a listen around, you may be surprised particularly when FO-20 is at low elevation over the Greenland icecap.

The Beacon

Good news!, FO-20's beacon was back to it's raspy self this morning (0112980925Z). Still sounding like *psk* modulation but never-the-less useful for checking propagation.

Jim W8VXH was absolutely *booming* in and we had a longer than usual chat discussing the state of the beacon. Jim had also been monitoring the the *Old Lady's* beacon these last few days.

It's good to see several *new* stations appearing on FO-20 lately. It presents a challenge to the mode-A operator trying out mode-J for the first time, particularly with the higher Doppler rate. As long as one uses an efficient antenna, power between 5 and 20 watts to the antenna is adequate. Using 50 watts to a groundplane is *very inefficient* but some hams may be

forced to do it that way due to antenna constraints and etc. A simple small indoor beam in the attic using low power is far more sensible and cost efficient than *a lot of watts* to a groundplane. Tracking? Have the beam in the shack and use an *Armstrong* rotator (See LA2QAA's satellite quad in a previous *OSCAR News*, *The AMSAT Journal*, and *amsat-bb*). The point is **don't** clobber FO-20 with excessive power, it's not necessary! It only causes extra *QRM*, *shortens the effective life of the satellite* as well as ensuring you will be an *alligator*. **Don't do it.**

More FO-20

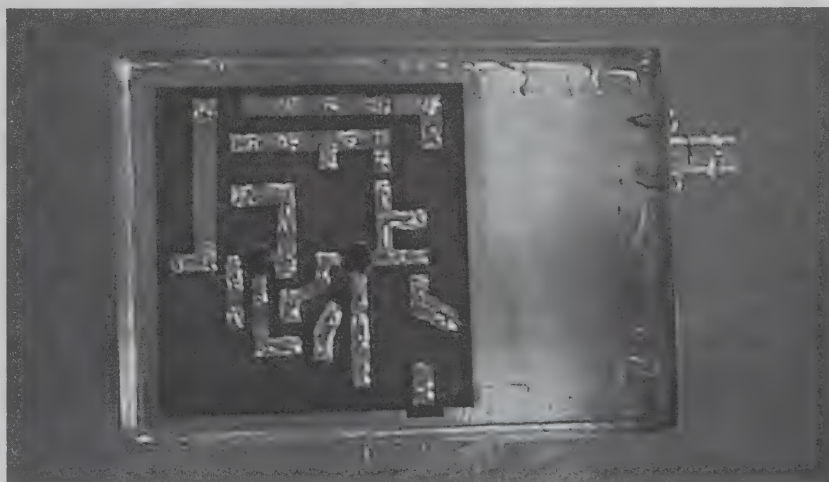
Normally I operate FO-20 on the morning passes but the cycle at the time of writing (09DEC98) is such that there is a reasonable pass for this QTH in the evenings as well. I have been working a few of the evening regulars: DG5LAE, PE1KNL and G7MJX Dave who like me uses fixed elevation on the FO-20 birds (LA2QAA being just too bone idle to put the elevation rotor back on the tripod). This evening between 1947 and 1959 UTC there was a G station calling CQ with a good S8 signal. I called him as did several other stations (actually his suffix was GMT, a bit of a coincidence). Anyway, since he could not or would not answer any of us I called CQ myself and Dave G7MJX came back immediately. The gentleman was still calling CQ on the top but by tuning slightly to one side I was able to QSO with Dave without trouble. I invited the other G station to join us but he just carried on calling CQ on top of our QSO. Of course the propagation can play a certain role in that stations not being able to hear their own downlink can often be copied by other stations perfectly well. I find it rather odd that

the G station concerned could hear neither LA2QAA, G7MJX or DG5LAE., all *booming* in with S8 signals. He just carried on calling CQ regardless. There is the possibility that it was someone just *messing about* but it is more probable that it was a station who had either disconnected the *receiver* or was using an *indoor* 6- inch nail as a receive antenna. A 6-inch nail and a piece of wet string is fine for RS-13 but you need a *pair of phased* 6-inch nails for FO-20 (at least). Even with a pair of 'em the trick is to **listen** occasionally between the CQ FO-20, CQ FO-20, CQ FO-20, CQ FO-20, CQ FO-20, CQ FO-20 CQ..infinite.

For the newcomer: You should not even try to transmit until you can adequately receive. As I've previously mentioned, the beacon on FO-20 is way under par but the beacon on FO-29 is performing as it should. If you can't hear the beacon on FO-29 with *at least* an S5 signal then your receiving system (probably the antenna) is simply not good enough and steps should be taken to improve it.

Burp! (The local repeater?)

I trust everyone has recovered from an excess of turkey, plum pud and other delicacies associated with late December. Due to the deadline I was unable to get my Christmas wishes *in print* in the December issue. I would like to thank all the stations who have given me **many** interesting QSO's in the last 12 months, particularly my *twin* G7NFO and a special thank you to my own partner in crime GM1SXX. Please *don't* send me any more of your *used* gales this year. Keep 'em to yourself! The first station to operate LA2QAA via **Phase 3D** wins a free unpaid sightseeing trip to CREWE! ■



Backside of YAMS (photo by LA2QAA)

AMSAT-NA Financial Statement and Auditor's Report Available

The AMSAT-NA's 1997 annual financial statement and auditor's report are available for member's review. If you would like to receive a copy send a self-addressed 10" x 13" envelope to the AMSAT-NA headquarters address that is provided on page 3.

Houston AMSAT Net News

On December 1, 1998, the Houston AMSAT Net along with all other W0KIE shows moved from KU-Band Satellite to C-Band Satellite GE-1 (83W) Transponder 12, 5.7Mhz Audio. The Houston AMSAT Net airs live every Tuesday evening at 2000 CST (Wednesday morning 0200 UTC) on local Houston repeaters, C-Band satellite and world-wide via the Internet Real Audio at <http://www.amsatnet.com>. During the net check-ins via Internet can be made to kk5do@amsat.org.

Human Amateur Radio in Space Celebrates 15 Years and Other SAREX News

Fifteen years ago on 28 November 1983, NASA Astronaut Owen Garriott, W5LFL, was launched into space on STS-9. He brought along the first Amateur Radio station on a crew-tended space vehicle. Thousands heard Owen's downlink and hundreds had a direct QSO with him.

Since that time 15 years ago we, the internationally-based human spaceflight Amateur Radio community, have done some pretty tremendous things for Amateur Radio and for education. Frank Bauer, KA3HDO and the SAREX team wants to take this opportunity to thank and to congratulate the hundreds of volunteers around the world who have taken the dream that was shared by Owen, the ARRL, AMSAT-NA and NASA and turned it into a reality that has benefited the world-wide community of radio amateurs as well as students in classrooms. Through your efforts, we have Amateur Radio stations that have flown on all Space Shuttles and on *Mir*. We are currently on the threshold of installing a permanent Amateur Radio station on International Space Station.

On behalf of the SAREX Working Group and as a US Delegate to the Amateur Radio on the International Space Station (ARISS) program, KA3HDO looks forward the continued cooperation of all the international partners that comprise ARISS as we jointly forge a new, exciting future for amateur radio in space.

Also with a big lull looming for SAREX school contacts, NASA is toying with the idea of launching a more earthbound version of the SAREX program that puts youngsters in direct contact with astronauts via Amateur Radio.

Last November, a group of pupils at the Pleasant Valley School in Winfield, Kansas, gave the idea a test flight during a 20-meter QSO with NASA astronaut Laurel Clark, KC5ZSU. Clark, a NASA mission specialist, spoke to the kids from the W5RRR station at the Johnson Space Center in Houston.

Helping out with the arrangements was John Nickel, WD5EEV, an early member of the SAREX Working Group. "I set up a portable station at the school, so we were all in a very full class room," WD5EEV explained.

The sole SAREX mission scheduled for 1999 is currently scheduled for early April, and construction of the International Space Station is only now under way. Amateur Radio is considered *required crew equipment* aboard ISS, but the first Earth-to-ISS school contacts are at least a few years away.

ARRL Educational Activities Department Manager Rosalie White, WA1STO, of the SAREX Working Group said similar terrestrial but space-related contacts could fill the impending gap in the SAREX program. "This terrestrial QSO was a test to see how this new project involving astronauts and schools can work," she said. "These exciting school contacts can tide us over until we're all set for future International Space Station contacts."

SAREX Working Group Chairman Roy Neal, K6DUE, agreed. He called the idea "an excellent way to stay in touch with our schools while SAREX converts into ARISS facilities over the next few years."

Matt Bordelon, KC5BTL, SAREX Principal Investigator at NASA, also helped with the arrangements. He said the current plan is to attempt these types of contacts on an occasional basis, spending about 30 minutes with a school via HF or using one of the current analog amateur satellites. "It gives the

astronauts practice with school contacts via Amateur Radio, and it keeps ham radio visible," he said.

Errata

Two errors were made in the November/December 1998 issue of *The AMSAT Journal*:

- On page nine there is a list of 1998 AMSAT Awards recipients that include Lyle Johnson, WA7GXD for Phase 3D Internal Housekeeping Unit (IHU) -2 Testing and Chuck Green, N0ADI for IHU-2 Design and Testing. WA7GXD's award was actually for IHU-2 *Design and Testing* and N0ADI's award was for IHU-2 *Construction and Testing*.
- The person in the bottom photograph on page 6 is not Cliff Uneyda, KJ6HC of Kenwood Communications Corporation. Rather it is Dr. Robert Zee, Acting Manager of the Space Flight Laboratory, University of Toronto Institute for Aerospace Studies. Dr. Zee is a key principal in the Microvariability and Oscillation of Stars (MOST) satellite project.

The AMSAT Journal apologies for these mistakes.

SO-33 News

Recently Dennis Wingo, KD4ETA informed subscribers of *amsat-bb* that SEDSAT (SO-33) ground control team may be nearing the end of their efforts to recover the satellite. They have found out that one of the two Mode L receivers on board the satellite was non-functional when it was launched. This was due to the removal of a part during final integration of the satellite due to a fit problem. There is a strong possibility that this was the main receiver. The second receiver, even if it is working may be useless. KD4ETA notes that there are several receivers on most of the UoSats and SEDSAT is communications section design is exactly the same. It turns out that part of the initialization sequence was not implemented for the second receiver by the UAH team for unknown reasons.

There is a possibility, whereby the ground control team may be able to get around this problem but it will require some very close coordination with the beginning of the operating period after the satellite comes out of its safe mode. As Wakita Mineo, JE9PEL

has correctly pointed out, SEDSAT *live* time is increasing. It is KD4ETA's theory that this is due to the day/night cycle ratio increasing. If the satellite gets to 80/20 day/night the SEDSAT will go power positive until that ratio drops below about 78/22. The 80/20 ratio is possible and KD4ETA will drop the satellite into STK and figure out when this will be.

KD4ETA notes that the ground control team is getting some very good engineering telemetry that is giving NASA some data in which to evaluate the SEDSAT Nickel Metal Hydride batteries. So SEDSAT is not a total loss. Wingo also asks that those who are copying and providing SEDSAT telemetry data continue to do so as these data are very important as the ground control team who may be able to figure out a way to get around some of the known problems with the uplink receiver.

VOXSAT

Gustavo, LW2DTZ, tells ANS that Serge Samburov, RV3DR and Victor Kourilov were recent guests of AMSAT Argentina. When departing for Russia they took the completed VOXSAT satellite with them, and according to LW2DTZ, "they hope to have VOXSAT integrated into a Russian Module-M launch vehicle for insertion into orbit sometime in 1999.

The latest VoxSat status can be found at the following URL: <http://www.amsat-lu.org>

TO-31 News

In December 1998, Chris Jackson, G7UPN/ZL2TPO reported that TO-31 has been opened up for general amateur use. This has allowed Amateur Radio operators to use the store and forward communications on the spacecraft, and also download the high-resolution multispectral images.

It is hoped that Amateur Radio operators will take advantage of downloading the high-resolution multispectral images available from TO-31 and keep other traffic to a minimum. Due to current limitations with on-board memory, images will only be available on the satellite for a couple of days after they are taken. If other files (especially large files) are uploaded to the satellite, this will ultimately increase the amount of time taken to download images and they may therefore be deleted before they are completed.

> Unfortunately, the transmitter is still causing some problems and the on-board transmitter monitoring software has been modified to automatically cycle the transmitter power should it detect a problem. Stations may notice short periods of no downlink (up to 35 seconds) as a result of this, however the transmitter will generally remain on over all areas. Presently these short outages are occurring approximately every 45 minutes on average.

During some of these tests, access may again be limited to command stations only. If at any time the BBS is "SHUT" (as displayed in WiSP and etc.) please do not attempt to access the satellite as it may delay any command station activities that are being undertaken.

TO-31 Information:

- Downlink: 436.925MHz, 9600bd FSK
- Uplink: 145.925MHz, 9600bd FSK
- BBS Callsign: TMSAT1-12
- Broadcast Callsign: TMSAT1-11

SimSat Program Receives NASA Award

[Via AMSAT News Service] AMSAT Area Coordinator Pat Kilroy, WD8LAQ, tells ANS that the Simulated Satellite (SimSat) Project recently won a NASA Goddard Space Flight Center Director's Discretionary Fund (DDF) award. The Simulated Satellite project is an educational outreach program at NASA-GSFC.

According to Pat, "the award is good news for students and Amateur Radio alike." WD8LAQ reports the award includes funding (for the 1999 fiscal year) a university student engineer — working full time during the upcoming summer months helping further develop SimSat hardware — and at least one (and possibly more) teachers — helping to further develop the educational side of the SimSat program.

Pat recalls the original concept of SimSat was born during a local AMSAT-DC meeting. WD8LAQ and others were looking for a local project, admiring the balloon success of Andy MacAllister, W5ACM, Bill Brown, WB8ELK and Chuck Crist, WB9IHS. "The dream," Pat said, "was wanting to do something bigger and better for student education — all in a spirit of wholesome competition." The result was the SimSat program was born, based on the idea that designing, building and then flying, operating and recovering payloads by balloon

is a great stepping stone for helping youngsters learn about Oscar satellites.

The NASA Director's Discretionary Fund award means there is ample opportunity for Amateur Radio operators to participate in ham radio balloon flights and to share the fun with students. WD8LAQ tells AMSAT News Service that he will update ANS on the exciting developments that the DDF award will bring to the SimSat program in the future. For general information and the latest updates about the program, visit the SimSat web site at:

<http://garc.gsfc.nasa.gov/~simsat>
Information on how the DDF award process works can be found at the following URL: <http://ddf.gsfc.nasa.gov/>

AMSAT-UK 14th Colloquium Call for Papers

The 14th AMSAT-UK Colloquium, *SpaceComm '99*, will be held at Surrey University, Guildford, Surrey, U.K., from Friday, July 23rd to Sunday, July 25, 1999.

AMSAT-UK invite authors to submit papers, about Amateur Radio space and associated activities, for this event and for a proceedings document which will be published at the same time. We normally prefer authors to present the papers themselves rather than having someone else read them in the authors' absence, but we also welcome un-presented papers for the document.

Offers of Papers should be submitted as soon as possible; the final date for full documents is mid-June 1999 in order that the proceedings are available to participants. A second (and final) call for papers will issue about March 1999; probably at the same time as Colloquium booking information becomes available.

Submissions should be sent *only* to Richard Limebear, G3RWL via the following routes:

- **Internet e-mail:** g3rwl@amsat.org
- **Packet Radio:** G3RWL@GB7HSN.#32.GBR.EU
- **Satellite:** AO16, KO22, or KO25
- **Terrestrial mail:** R W L Limebear, G3RWL, 60 Willow Road, Enfield, EN1 3NQ, United Kingdom.

Minutes of the AMSAT Board of Director's Meeting

Held October 18 and 19, 1998 in Vicksburg, Mississippi

The meeting was convened by President Tynan at 1:05 PM on Sunday, October 18, 1998 at the Battlefield Inn, Vicksburg, MS. Members of the Board of Directors (BoD) in attendance were:

- Keith Baker KB1SF - Executive Vice President (VP)
- Tom Clark W3IWI - President Emeritus
- Dick Daniels W4PUJ
- Andy MacAllister W5ACM - VP User Services
- Bill Tynan W3XO - President
- Stan Wood WA4NFY - VP Engineering

Others participating at various times included:

- Frank Bauer KA3HDO - VP Manned Space Programs (by telephone)
- Bill Burden WB1BRE - VP Strategic Planning
- Martin Davidoff K2UBC
- Ken Ermandes N2WWD
- Art Feller W4ART - Treasurer
- Bdale Garbee N3EUA - Phase 3D RUDAK
- Robin Haighton VE3FRH - VP Canadian Liaison
- Lou McFadin W5DID - Phase 3D Integration Manager
- Dwane Naugle K06BT
- Jean Naugle KQ6QHT
- Keith Pugh W5IU - VP Operations
- Martha Saragovitz - Corporate Secretary
- H. Paul Shuch N6TX - Executive Director, The SETI League
- Ray Soifer W2RS - VP International Affairs (by telephone)
- Russ Tillman K5NRK - Editor, *The AMSAT Journal*
- Paul Williamson KB5MU - VP Electronic Publishing

I. MOST Satellite Agreement

Haighton led off this discussion, noting that the MOST (Microvariability and Oscillations of STars) astronomy mission was described in *The AMSAT Journal* for January/February 1998. He also reviewed AMSAT participation in the project to date and outlined the agreement as developed between the University of Toronto Institute for Aerospace Studies (UTIAS) and AMSAT under which AMSAT will participate in the design and testing phases of the construction of the MOST spacecraft. The agreement calls for AMSAT to put forth its best effort in providing mentoring services but not taking on risk factors such as agreeing to make available a particular individual at a specific time or supplying hardware. In recognition of this UTIAS will, at specified times throughout the project when certain design or construction phases have been completed, make contributions to AMSAT totaling \$400,000 (Canadian). Haighton acknowledged the assistance of Saragovitz, Feller, Baker, Tynan and others in the development of the contract.

Clark noted that the document carries an August date and that there have been significant changes made since then and asked Haighton to highlight

these. Haighton explained that the August date was retained so that AMSAT could be compensated for its expenses incurred in September. He went on to explain the changes in wording that had been made. Among these was the replacement throughout of "technical assistance" with the term "educational assistance." Tynan emphasized that the changes in language were made to better define AMSAT's relationship as one solely with UTIAS, and not with the other parties. Tynan further noted that, as mentors, AMSAT is not regarded as a responsible party and that the contract, as now proposed by us makes this point clear. Haighton stated that although no response had yet been received from UTIAS on this revision, he did not believe that would present a problem. He emphasized, however, that UTIAS would expect AMSAT to be represented at all reviews. Haighton then asked for the Board's approval of the contract as written. He promised that, if AMSAT's change in language is not agreed to, he will return to the board for further direction.

Clark moved that the agreement be approved, Daniels seconded, it passed unanimously and was signed by the officers. Tynan signed as the President at the time the agreement was dated and as of its approval by the Board.

II. Election and Appointment of Officers

Saragovitz presented the results of the annual election of Board members held in September. Incumbents Baker, Clark and MacAllister were reelected with Baines continuing as alternate until the next election. Tynan stated that more members need to be acquainted with the need to vote and estimated that only 20 percent of the membership cast a ballot this year.

Tynan restated his previous announcement that he is not available to serve as President for the coming year and recommended that the BoD elect Executive VP Baker to that position. He noted that Baker has served in that capacity for 4 years. No other candidates were proposed and Clark moved that the Secretary cast a unanimous ballot electing Baker as President. Tynan seconded and the motion passed by unanimous vote. Baker agreed to serve and assumed conduct of the meeting. He then proposed that VP Canadian Liaison Haighton be elected to replace him as Executive VP. Haighton mentioned that he had other commitments requiring his time but stated that AMSAT was of great importance to him and that he would accept the nomination.

Clark noted that this would be the first time AMSAT would have a citizen not of the USA as an officer and asked if anyone was aware of possible legal difficulties this might offer. Daniels said the only one he was aware of was the need to identify non-citizens when applying for an export license under ITAR and although there might be other situations where the question would be asked, he did not think it likely this would cause problems. Clark explained that he wanted to ask this question now and that if all were satisfied, then he would move that the Secretary cast a unanimous vote that Haighton be elected as Executive VP. Tynan seconded and the motion was carried without

exceptions. Haighton expressed his appreciation for the honor of his election and Tynan said that he thought it especially appropriate since we are AMSAT-NA not AMSAT-USA and one of our major activities is going to be the MOST project and because Haighton has already been designated by AMSAT as the single point of contact between us and UTIAS.

Next filled was the position of VP Engineering and Wood stated that he would accept the nomination. Daniels moved that a unanimous vote be cast, Baker provided a second and Wood was unanimously elected. Pugh agreed to serve if elected as VP Operations. He was nominated by Tynan with a second by Baker and Pugh was elected unanimously. Saragovitz agreed to continue to serve as Secretary and it was so moved by Daniels followed by a second by Tynan and she was unanimously elected. Feller was nominated by Baker to continue to serve as Treasurer, the nomination seconded by Tynan and he was reelected by unanimous vote.

Baker announced that Tynan has offered to continue to serve in some capacity that can help the new President and new Executive VP in assuming the day-to-day activities of the organization. It was suggested that the position of Chairman of the Board be created as it had been at other times in AMSAT history and that Tynan's assumption of that position would help to distribute the workload. The duties of the Chairman would be defined as handling BoD activities, establishing agendas for the meetings, reviewing the minutes and conducting the Board meetings. Feller asked what the Bylaws said about the position of Chairman of the Board and it was concluded that although the title is mentioned there, little else is said. Clark opined that the BoD acting as a committee can choose its own Chairman. Baker said that he was comfortable with this arrangement and it would provide the new President a point of contact with the Board and assembling them each time there was a major decision to be made. Baker made the motion that Tynan be elected as Chairman of the Board until his term as a Board member expires and Tynan added that he would not want to be Chairman if he were not a member of the BoD. Daniels seconded the motion and the motion carried unanimously with Tynan recused. Tynan then resumed conduct of the meeting. The other officers are appointed by the President and do not require Board action.

III. Presentation of the Budget for 1999

Tynan explained that after consulting with the Corporate Treasurer and Secretary the document, as presented, represents a reasonable estimate of the income and expense figures that might be expected in the coming year. Specifically, the figures for revenue from new members and renewals have been adjusted to reflect a best estimate based on recent history and current expectations. It was noted that the number of members renewing is holding fairly steady. The amount derived from fund raising activities is expected to be much lower than in previous years because of the completion of Phase 3D. Thus, no fund raising campaign is expected to be held for that project in 1999. However, it was

emphasized that a campaign to fund AMSAT's participation in the International Space Station project may take place. The total income anticipated is \$339,100 and includes income derived by providing educational assistance to the MOST project.

Expenses will include travel to support MOST, the Amateur Radio in Space (ARISS) program for the International Space Station and additional funding for Phase 3D. Feller noted that a new Department 19 has been added to the Chart of Accounts for MOST. The total estimated expenses for all departments come to \$500,300 leaving a projected deficit of \$168,200. Saragovitz noted that the item for travel to the Phase 3D launch was estimated to be \$50,000 and the total amount of expenses budgeted for Phase 3D in 1999 is \$170,000 with Phase 3D income estimated to be \$15,000. Launch expenses were included in the 1999 Budget even though no launch is presently on the horizon. This was done in the event that a launch opportunity unexpectedly arises. Daniels summarized by saying that \$100,000 should be set aside for the launch of Phase 3D. Feller noted that we had sent \$210,000 to AMSAT-DL to be forwarded to ESA as a launch deposit. Baker explained that this will keep kept in escrow for an eventual launch. It was explained that if a refund is in order it might be returned to AMSAT-DL and be kept in a European currency so as not to incur a loss from exchange fees. Alternatively, the deposit might be returned to AMSAT-NA and then be put on deposit. Tynan said that it is not planned to spend this on anything except a Phase 3D launch. Baker noted that at various times in the past organizations including ARRL and AMSAT-UK have contributed funds specifically designated for the Phase 3D launch and that the \$210,000 was derived from these designated donations. Feller asked if we could find out if the deposit is presently being kept in an interest bearing account and Daniels replied that we should not expect it to be collecting interest. Baker stated that Karl Meinzer and AMSAT-DL are more interested in finding a launch opportunity than getting some money back. It was decided not to pursue the issue of a refund and Tynan expressed the view that receiving a refund from ESA now would lessen our chances of getting a launch from them.

With regard to other budget items Clark questioned the \$3,600 for e-mail expenses and Tynan asserted that for the remainder of the meeting the usual procedure be followed wherein questions about individual budget items for each department be asked as they come up for each department. Clark asked what department is renting equipment and Saragovitz explained that this would include the postage meter for the office. Haighton asked if AMSAT has liability insurance? Saragovitz said the BoD members and officers are covered. Daniels asked if the Phase 3D spacecraft is insured for transport? Tynan replied that it is insured for \$3,000,000 and that the policy covers transporting it and all other conditions right up until, but not including, launch. He added that the cost of the policy is \$13,500 for the period October 1, 1998 through September 30, 1999. The same amount would be due for coverage in the following year. Further discussion and approval of the Budget was deferred until each department is reviewed.

IV. Phase 3D Progress Report

Lou McFadin reported that the spacecraft is currently at Orbital Sciences Corporation in Germantown, Maryland awaiting thermal vacuum testing. This will be complete by the end of October. Daniels asked if all the builders of subassemblies knew that their hardware will encapsulated after thermal vacuum testing is complete? McFadin replied that as far as he knew they had been notified. The question was raised if vibration testing should be done before a commitment to launch is identified. The answer given was that this has not been decided yet. Daniels recommended that good photographs be taken of the placement of subassemblies. Baker asked if the shake test standards have changed since the Ariane 502 flight and the answer was that AMSAT has not been notified of any such changes. Daniels opined that no announcement of this would likely be received until after the 503 launch.

Wood described the schedule planned for the Orlando Phase 3D facility. Encapsulation should begin at the end of November and run through the second week of December. He indicated that, in general, modules constructed in the USA will not require foaming as they employ Eccofoam coating. He and McFadin stated that tentatively, preparations will be made for shake testing during the second or third week of January, with the spacecraft returning to Orlando around February 1. After unloading, finalization and document updating the laboratory shutdown should be possible during that month.

Completion of the modifications to the SBS will take about a month. Daniels pointed out that launch options other than Ariane might not require the SBS. If launch is to be on an Ariane 5 it should be possible to get Phase 3D ready in a month's time. Baker asked if paid persons are needed to achieve these final tasks? Wood said that it would be difficult but probably could be done. He added that the one item remaining requiring the paid workers is mounting and testing the solar panels. He also noted that Rick Leon will be needed until the shake test is completed. Baker stated that financial considerations will make it necessary to soon cut back on the contract staff and that he wants the Board to make such a decision.

Baker asked if we have a commitment for the vibration tests. Daniels replied that it hasn't been decided yet but the earliest date will be in January and because of scheduling conflicts at Goddard a delay may be encountered. He said these tests should be accomplished as soon as possible and that Goddard is prepared now to do both vibration and acoustic tests. An extensive discussion followed about the details of the shake testing. It was stated that only Goddard has the facilities to approach the ESA required levels. Daniels described the safety considerations and Baker asked that Daniels, Tynan, McFadin and Wood find out what the issues are and come up with a plan.

V. Phase 3D Finances

Wood again brought up the subject of when the Orlando facility can be shut down. He said if the satellite returns from the shake test on schedule the February date can probably be met. After that, the spacecraft can either be stored or put on long term life tests. Karl Meinzer must make a decision as to which. Wood said that the lab building is expected to be there for another two years before it is torn down. The monthly rent at present is about \$1,200

plus \$500 for the office space. If the Lab is being run by a small crew, the office space could be dispensed with. So, even if the satellite is put on life test at that location, it should be possible to reduce expenses to about \$1,500 to \$2,000 per month if only volunteer help is used.

Tynan asked if the Airport Authority will want another one year lease or will consider renting on a monthly basis. Wood opined that they would likely be willing to rent the space to us on a monthly basis starting in November when the present lease is up; and that we can probably vacate with a 30-day notice. Tynan noted that rent for Phase 3D in 1999 is budgeted at \$20k and the Board agreed that this was a reasonable figure.

Baker presented the financial aspects and personnel issues involved with Phase 3D. As of September 30, 1998 AMSAT-NA has spent about \$1,641,000 plus the \$210,000 launch payment for a total of \$1,850,000. Projecting expenses to completion only through January 31, 1999 plus possible future contract work in connection with a launch, comes to a possible \$50,000 more. Wood asked how much money is in the launch campaign and Baker said about \$100,000. Considering this plus a possible additional launch payment brings the estimated total cost to over \$2,000,000. It was noted that the cost of liquid nitrogen for thermal vacuum tests is expected to be \$10,000.

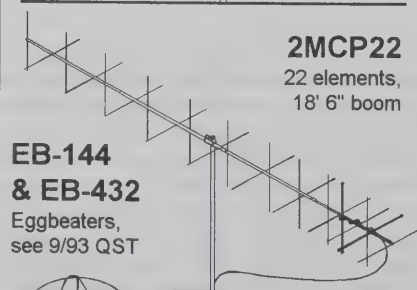
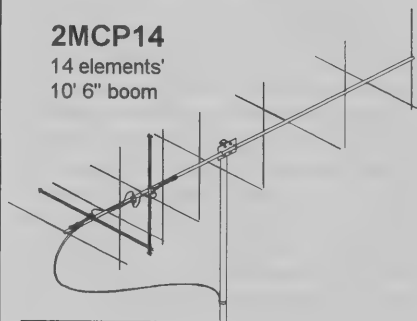
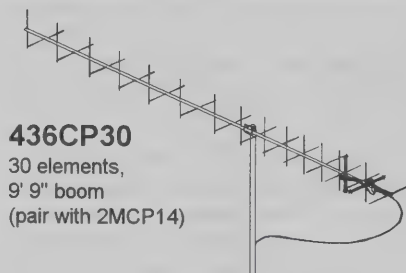
Income for Phase 3D from 1992 to date from 1992 is about \$1,794,000. Baker said that possibly \$30,000 more could be raised bringing the Phase 3D total income to \$1,820,000. Comparing the amount received for Phase 3D back to day one versus the expenses indicates that we are about \$57,300 in the hole as of September 30. This is coming out of the \$100,000 that the Board had previously authorized to be taken out of AMSAT funds that had not come from Phase 3D fundraising. Baker noted that expenses are accumulating at the rate of \$15,000 to \$20,000 per month and five more months of work and expenses had been projected so it may be necessary to spend \$200,000 more including launch expenses. Tynan opined that, in the absence of a defined launch opportunity, we cannot expect to raise additional money for Phase 3D from our members.

Wood stated that if the group from Germany is delayed in coming to Orlando to do the foaming, we should ask them for financial assistance to cover the expense of the schedule stretch-out that this would entail. Baker said that he had notified Karl Meinzer that AMSAT-NA is concerned about dipping so heavily into our reserves, noting that our membership is down in numbers and we are unable to effectively raise funds with no launch in sight. He also advised him that the \$100,000 cap on spending was voted upon at last year's Board meeting and now we are spending ever-increasing sums without much money coming in, and that this cannot continue indefinitely. Meinzer has replied that he might be able to send another \$50,000 out of his launch reserves and noted that AMSAT-DL also has financial problems.

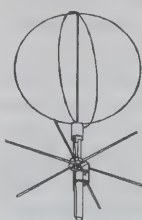
Daniels commented that Meinzer and others stated the need to know, before the vibration tests, what vehicle Phase 3D will be launched; as such information can be used to set levels and spectra. Upon consideration of this and the likelihood that there may not be a launch in 1999, he opined that it

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might make better sense to not foam the boxes at this time; but to put the spacecraft in storage. And then when a launch is identified, do the potting and vibration testing.

On the other hand, Daniels stressed a need to conduct the vibration tests as soon as possible, because the facilities at Goddard may not be available to us forever. The tests, he said, could be done at the maximum level the facility is capable of producing. Documentation of the results of such tests should be sufficient to demonstrate to a launch authority the structural integrity of our spacecraft.

Wood asked what will happen if the foaming is not done in December. Tynan replied that, in that case, and without additional money, we will be forced to shut the lab down December 31. Wood agreed. McFadin, however, said that it is very important to keep a paid staff on in Orlando long enough to complete the spacecraft documentation. Clark agreed to the value of completing the documentation but stated a need to *draw the line in the sand* and at present that time line is December 31 with current funding and the end of February with an additional \$50,000.

It was suggested that by about mid-November, after completion of the thermal vacuum tests, the Board will have a better idea of what the situation is and how much money will be needed to complete. Daniels recommended that the request for funds from Germany be made more as a technical decision of how to run the project rather than making a decision based on how much money Meinzer can contribute.

Baker agreed urging the Board to establish a deadline beyond which time the project must be complete. He added that, while an additional \$50,000 would get the project to the end of February, the spending limit established by the Board must be raised to \$200,000. MacAllister expressed a similar opinion saying that the Board must go on record with respect how to proceed and stop stretching things out. Daniels agreed and said there are two possible scenarios 1) completing the spacecraft which will involve completing the shake testing in January and then going into storage, or 2) putting the uncompleted Phase 3D into storage with whatever happens after that determined by when Dr. Meinzer decides the time is appropriate for the shake test. It was reiterated that Dr. Meinzer is the project leader and that he must make the decisions as to when and how these various events and scenarios take place.

Tynan noted that a good opportunity to discuss the financial situation with Meinzer would be at the site of the thermal tests in Maryland and suggested that Baker travel there and speak with him face to face. After more discussion, it was concluded that Baker would talk to Meinzer on the telephone about the matter while the latter is in Maryland.

Wood said that the appearance of the satellite is outstanding. McFadin remarked that the Orlando crew had been working very hard during the past year making mechanical and other changes.

Baker summarized by making the following resolution. *We, AMSAT-NA, are willing to support the Phase 3D project through the end of 1998 based on the lack of a decision to proceed beyond the first phase of testing. On the other hand, if there is a decision to proceed with vibration testing, we will*

do so readily to get the work on the spacecraft completed. But, in order to do this, we will have to ask for additional funding. MacAllister so moved, Baker seconded and the motion to accept the resolution was unanimously approved. The matter will be discussed by telephone by Baker with Meinzer at the time of the thermal vacuum tests. Then in November after the Phase 3D testing situation has been clarified the BoD will meet by telephone to present and discuss the 1999 budget for Phase 3D.

VI. SAREX and the International Space Station (ISS)

Bauer presented his report by telephone. He outlined the happenings of the past year and mentioned that this information was available in the ISS portion of the AMSAT web site.

He also said that a noteworthy event this past year was the excellent progress made by AMSAT, APRS and the Amateur Radio community to move APRS activity from 145.79 to 144.39 MHz so as to avoid interference to the proposed 145.80 MHz manned space downlink frequency. Tynan noted that Bob Bruninga had presented a talk on the previous day describing TRAKNET, an APRS-related satellite amateur mobile satellite system after which he and the entire APRS community were thanked for their fine cooperation. Baker said that at the recent Digital Communications Conference in Chicago, Greg Jones, Steve Dimsey and Bauer gave a talk on the frequency change for APRS and declared that the campaign was considered a success. Now, the majority of APRS users in the USA and Canada are on one frequency, 144.39 MHz.

The SAREX activity planned for STS-95 was cancelled because of complexities introduced by the participation of Senator Glenn. The next Shuttle mission to carry SAREX will be STS-93 expected to fly in March 1999. This is likely to be one of the last missions carrying SAREX for a while.

The Board was asked to recognize the change of name for SAREX to now signify Space Amateur Radio Experiment rather than the former Shuttle Amateur Radio Experiment. This is appropriate because there has been Amateur Radio on all the types of human space flight vehicles with which NASA is currently involved, namely, the Shuttle, then MIR and now the ISS. He said that the name change has been recognized by the NASA Web page and the ARRL. Tynan moved that the officially recognized designation SAREX henceforth will be defined to mean Space Amateur Radio Experiment. Daniels seconded and the motion passed unanimously.

Bauer also asked that his title of VP for Manned Space Programs be changed to VP for Human Space Flight Programs for reasons of political correctness. This change came under the jurisdiction of the President and Baker made the title change official.

The segment of the ISS that represents the amateur International Partners is now called ARISS for Amateur Radio on the ISS. Bauer said that the SAREX group was not doing much with *Mir* at present but that they have a good relationship with group headed by Dave Larsen called the MIREX team. He noted that there is another *Mir* interest group called MAREX-NA, which is a rival to MIREX and is not recognized by them.

Bauer said that because of his increasing professional responsibilities he has recruited Will Marchant to serve as SAREX Operations Manager beginning with the flight of STS-93. Marchant will assume Bauers's duties as AMSAT's liaison with the Shuttle program. Bauer agreed to continue as a VP for Human Space Flight Programs until such time as a viable candidate is found to replace him. Roy Neal has asked Bauer him to make certain that all is in place to get the Amateur Radio equipment going for the ISS. Bauer said he will try find help in the form of an ARISS Operations Manager and a Hardware Manager. Baker stated that he preferred to see Bauer in the role of an overseer rather than a hands-on worker in these efforts and that would like him to continue in his VP position for as long as he believes he can continue to make a contribution. Bauer agreed to this for the present and said that, if his situation changes, he will advise the President with as much notice as possible.

Bauer stated that he was very impressed with all the International Partners with whom he met at this year's AMSAT-UK Symposium in Surrey. They had good meetings and accomplished a lot. They were extremely cooperative in wanting to work together on the project as a team. The Germans had some good proposals and the Italians are planning antenna designs and had good ideas for the permanent hardware and McFadin from the USA also contributed good ideas on hardware development.

There has also been progress made in developing transportable stations. These are basically 2 meter and 70 cm handhelds and a PACCOMM Pico TNC that may fly on STS-88 later this year and on STS-96 early in 1998. McFadin has finished the activities with regard to interfacing transceivers with the packet system. The equipment has been shipped to White Sands where it is undergoing tests. It will then come back to Goddard where more EMI tests will be run so that it should soon be ready for flight. That things are going so well in this area is attributable to the efforts of Marchant and Bauer to obtain funding by the NASA Director's office, to get the Ericsson radios donated and to McFadin who has been working on the packet system. These activities are to be considered a milestone in the beginning of the ARISS project.

Daniels asked about the question of an Amateur Radio callsign for the ISS that had been brought up at the Surrey meeting. The suggestion had been made there, to request that the call 4UISS. Daniels said that Larry Price of the ARRL did not think this was possible because UN calls are for use only by UN bodies such as the ITU and UN Headquarters. Feller said that there is the option of the ITU Secretary General, subject to approval by conference, to set up new callsign blocks and could conceivably do so for international projects of this nature. Daniels opined that Price will likely take no action in this matter. Bauer said that after all components are launched the ISS becomes a US vessel and thus it would be appropriate to have a US callsign; although some of the partners might object. The third party activities on the ISS must be taken into account. Feller said he thought the FCC might have no objection and lift the third party restriction in this case. He offered to contact the FCC in an effort to clarify the callsign issue.

With regard to frequencies, Bauer said now that APRS operations have moved down from 145.79

MHz, the 145.80 MHz frequency will be the permanent downlink for SAREX operations. A secondary downlink frequency of 145.99 has been proposed. The uplink frequencies are a more difficult matter from the international perspective with 144.45, 144.47 and 145.49 MHz being considered, at present. The first two of these do not conform to the Region 1 bandplan and 144.99 MHz is only authorized for use there until 1999. Hans van de Groenendaal has been pushing this hard but so far hasn't been successful in resolving this problem.

The budget for Human Space Flight Programs department was approved. Significant items include: components \$8,000, telephone/telex \$2,000 and travel \$15,000. Baker said \$10,000 of income was estimated under the assumption that a fund raising effort for ARISS would begin sometime in 1999. Bauer reminded the Board that as a federal employee he cannot actively participate in fund raising although he would provide advice about why this project is important to hams. He thought that more than \$10,000 might be raised. McFadin asked if AMSAT would be able to help pay for travel by the International Partners. Bauer responded that each country should fund the expenses for their own people. McFadin thought the \$8,000 budgeted for components might be low and Bauer countered with the thought that it would be sufficient by pursuing donations. Bauer indicated that NASA will take care of expenses for hardware qualification. On the other hand if something like the computer controlled Kachina transceiver system, as has been proposed by McFadin, is selected \$8,000 will not come close to what is needed. Tynan asked if Kachina might donate a system but Bauer stated that a total of six systems are needed. He also said that for 1999 NASA funding is primarily for the developmental aspects and possibly to buy some prototype hardware. It was concluded that fund raising for hardware is now the most important thing.

Tynan asked if AMSAT could receive NASA funds for hardware. Bauer said there has to be a clean cut between what AMSAT and ARRL do and what NASA does and that any hardware provided by AMSAT would have to be paid for by AMSAT and/or ARRL. Thus far, NASA has contributed to the expenses of qualification of the hardware and purchases of some equipment that will remain Government property. Bauer added that NASA money will never go directly to AMSAT and that it's AMSAT's and ARRL's responsibility to try to maximize donations. He said that this had recently been discussed with the NASA representative for SAREX, and a full-up budget and new MOU between NASA, ARRL and AMSAT will be presented. Baker said this could be modeled on the one for SAREX. McFadin opined that the present arrangement wasn't working in our favor and Bauer replied that the big thing we get is a ride and that's not inexpensive, plus the qualification of the hardware by NASA, also is not inexpensive. Tynan stated his belief that the major ham radio manufacturers would be eager to provide the amateur equipment for the ISS. Bauer said that Kenwood and Icom have been very enthusiastic. The possible role of the International Partners in hardware development and procurement was discussed. Haighton said that he had represented Canadian amateurs at the Surrey meeting and had expressed concerns about the expenditures for the main ISS station. He wondered how an organization like the Radio Amateurs of Canada (RAC), which

like AMSAT is short of funds, would be able to make a contribution. He thought that simpler specifications for the equipment would be a way to reduce costs. Bauer said he shared these concerns and thinks that he and McFadin will be looking to see what the best approach is. Bauer said that a meeting of the Hardware Committee is needed soon. Haighton said that we will have a hard time in raising money. Clark said that AMSAT-NA obviously has some obligations here for the US commitment and asked do we also have some obligations for the Canadian part? Haighton answered that in his opinion the answer was yes. Clark said he didn't think this had been included in Bauer's budget. Bauer confirmed this and agreed it was a good question. Tynan said that he had assumed that Haighton was primarily representing the RAC at the Surrey meetings rather than AMSAT-NA. Haighton differed and said that since each country is permitted two delegates, one from an AMSAT organization and one national radio society delegate, he was acting there as the Canadian AMSAT delegate. Clark replied that he didn't think the question would be answered at the present meeting and wanted to make it clear that he was not advocating that AMSAT send money to cover this.

Baker thanked Bauer for his many efforts and expressed his appreciation for Bauer agreeing to stay on as VP for Human Flight Projects in spite of his new professional responsibilities. Bauer then concluded his participation by telephone.

VII. AMSAT Package on MOST

It was announced that AMSAT has been given space, weight and power allowances for a hardware package on the MOST satellite that is to be in a 785 km high, sun-synchronous, dawn to dusk orbit. Thus, the MOST spacecraft represents an attractive platform for an Amateur Radio project. Haighton as the AMSAT Single Point of Contact for the MOST project has asked for suggestions for such a package, including making a presentation the previous day at the AMSAT Space Symposium. He said that whatever is proposed, we should have a decision by the end of the year, certainly by the end of January. He emphasized that whatever we end up with, must have the approval of the MOST project leaders. He expected that they would be supportive as long as the amateur project conforms to the physical space and power budget allocated. Tynan made the point that any group responding, be it group of individuals or a university group, must be in a position to supply the package; not merely propose something that someone else should build.

Garbee said that he and Lyle Johnson, Harold Price and several others, attending the MOST meeting in Toronto in September, spent some of their free time thinking about what type of amateur project might be interesting, and have capabilities that would motivate both experimentation and for-fun activities. He said that they had rejected the idea of another store-and-forward digital transponder, or camera, because these functions have been well covered by other spacecraft. Neither did they think that a Mode A transponder would be appropriate for this particular mission because the large antenna required for 10 meters might endanger the ability of the MOST satellite to meet the precise pointing required to keep its telescope trained on a single star for weeks at a time. This is the primary objective of the MOST mission. Their proposal for amateur payload would include a broadband Mode

L uplink and a Mode S downlink. A lengthy discussion followed as to the functions that such a package might make possible, including the advisability and/or advantage of including a tunable receiver. Digital signal processing and the ability to accommodate several modulation modes was also mentioned. Tynan asked about the possibility of flying a spread spectrum device, possibly one which reconstitutes the bits in the satellite, thus eliminating the advantage that high power stations have on current amateur spacecraft.

It was speculated that several circuit blocks developed for Phase 3D might be used. These might include the IQ Modulator Block invented by

Johnson, Miller and Meinzer for the IHU-2 using the StrongARM processor. This, package might be able to perform as an analog transponder, a digital store and forward device or a transponder with mixed modulation schemes such as FM up and SSB down. Tynan asked about bandwidth and Garbee said he considered it premature to set detailed specifications so early. But he indicated that the payload they propose would provide the infrastructure to support a much higher data rate than any AMSAT device has embodied to date. The possibility of doing experiments with spread spectrum technology were also mentioned. Clark suggested that the MOST amateur package be able to serve as a backup for main MOST communications equipment. He

speculated that the MOST data might be of interest to amateurs and students. He also suggested that the group consider the opposite of a highly complicated design in favor of something simple with a two-meter downlink and voice synthesized downlink to replace DOVE. Garbee said he would prefer an S-Band downlink for any DOVE-type package. He contended that it would be easy for hams to find equipment to receive such a downlink, in the light of the availability of S Band TV downconverters. These, he said, can be used with any 2 meter receiver including HTs. Clark suggested that new technology, now available, could enhance a DOVE-type project.

Clark noted that MOST will always have one face toward the sun and the opposite face pointed away from it. Any one of the other faces of the spacecraft will point toward the earth 25 percent of the time so the antenna design must take this into consideration.

Garbee summarized by stating that his purpose in making this report was to make the Board aware that a subset of AMSAT members who met at Toronto to help out UTIAS, have put considerable thought into an Amateur Radio project to fly on MOST. This could use components from other recent AMSAT projects and would be a low stress, fun-to-do activity and provide motivation to TAPR to work on ground station gear for the high-speed modem on Phase 3D. He said that this is an exciting payload opportunity and that he will make certain that Haighton receives more information about what had been circulated among the prospective builders.

VIII. 1999 Meeting Site

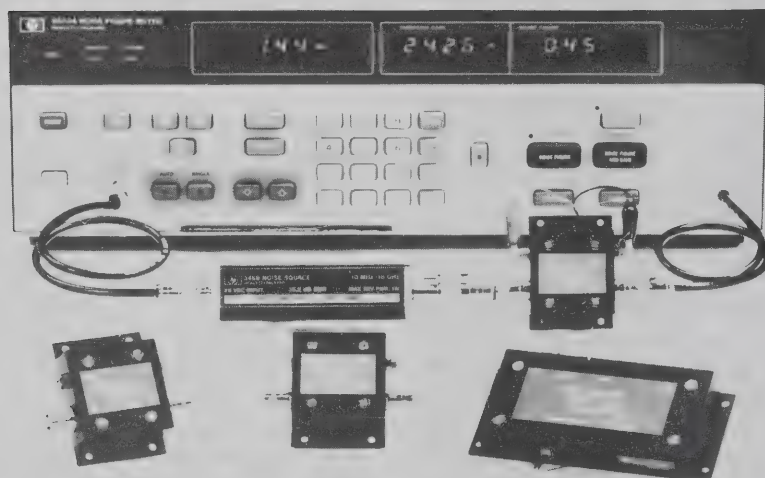
Jean and Dwane Naugle presented a proposal that next year's Annual Meeting and Space Symposium be held in San Diego. They described the facilities and attractions available in the city and the results of their survey of the hotels that might meet AMSAT's requirements. They reported that their survey of the hotels disclosed that the less expensive hotels were not large enough to handle an AMSAT meeting. They recommended either the Hanalei or the Quality Resort, the Hanalei being slightly more expensive.

Clark said that he hoped that the dates for the meeting could return to the Columbus Day weekend. Jean Naugle said that next year this would be October 8, 9 and 10 and that she had already considered that as well as the expectation there would be an IARU satellite meeting before the AMSAT meeting, so in preparation had arranged a room lock for the Wednesday through Tuesday before and after the Columbus Day weekend. Baker agreed that it was our turn to host the international meeting because it had been held in Surrey this year. Tynan commented that, the Europeans he talked to last summer, thought that San Diego is a good choice for a meeting site as Los Angeles is convenient for international air travelers.

Baker moved that for 1999 the AMSAT meeting be held in San Diego, Tynan seconded and the motion passed by unanimous vote. The question of which hotel was left to a decision of the President. Saragovitz and others will participate in the final arrangements and distribution of promotional materials.

Daniels noted that it takes a fairly large group of volunteers to host a convention and asked if there

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were others in San Diego willing to help out? Duane Naugle said that about a dozen individuals had given verbal assurances of their willingness to assist in some way. Several other notable AMSAT members live in the area and may be willing to assist. Jean Naugle stated that upon their return to California they will make contact with other prospective volunteers.

IX. International and IARU Matters

Soifer reported by telephone on what has been a busy year for AMSAT's international activities and our growing relationship with the IARU. He reviewed impending IARU personnel changes. In August he chaired the IARU Satellite Forum and participated in the ARISS meeting, both held in conjunction with the AMSAT-UK Colloquium in Surrey.

A plenary session Soifer made an invited presentation on behalf of AMSAT-NA and IARU Satellite Adviser van de Groenendaal. The conference also asked Soifer to serve as Secretary of the working group concerned with VHF/UHF/SHF activities. In addition to this meeting he had represented AMSAT-NA at the RSGB VHF Convention in February as well as the Annual General Meeting of AMSAT-UK in August. The text of his presentation to the IARU Region II meeting appears in the November/December 1998 issue of *The AMSAT Journal*.

Soifer asked the Board to take three actions that he believed would be non-controversial. The first was for AMSAT-NA to express its thanks for being invited to participate in the IARU Region II Conference, MARGARITA 98, held at Porlamar, Venezuela in September; and express the hope that our participation was helpful and express the hope that we will be invited to participate in future conferences. He noted that this was the first such conference to which we had been invited. Clark moved an appropriate resolution and Tynan seconded. The resolution passed unanimously. Soifer offered to cooperate with Baker in the writing of an appropriate letter.

The second item concerned a resolution passed at the Region II Conference that Soifer had promised to bring before the AMSAT Board. The IARU resolution reads as follows:

Introduction: Satellite activities in the Southern Hemisphere, in general and in our Region in particular, show that we have much to do in this area. In order to promote satellite communications, it is necessary that member societies motivate adequately the potential users through conference demonstrations, seminars, installation of club stations, satellite versions of operating awards, adequate libraries, etc. On the other hand, such programs would be effective only if satellites are in appropriate orbits and are not turned off over the Southern Hemisphere.

Recommendation: The Committee recommends that Region 2 request from the Member Societies their best efforts to motivate and offer appropriate instruction to radio amateurs in their countries about satellite communications, and to request the appropriate organizations which place Amateur Radio satellites into orbit and/or control such satellites through telecommand to cooperate effectively in order to allow greater participation of

radio amateurs in the Southern Hemisphere. The secretary of Region 2 is requested to request the support and cooperation of Regions 1 and 3 as well as that of the IARU Satellite Adviser. Soifer asked the BoD to take note of this resolution and agree that Amateur Radio satellites should be accessible by amateurs throughout the world to the extent practical.

Clark moved that AMSAT-NA notes with pleasure that IARU Region 2 recommends expanded amateur satellite activities in throughout Region 2 and that we thank them for their consideration. Baker seconded and the motion passed unanimously.

Third, Soifer noted that he had also been requested to participate in an informal session organized around Rinaldo's *White Paper on Development of the Next Generation of Amateur Radio Systems*. The purpose of the session was to set up an informal working group to follow through on the paper's ideas. The document proposes that an informal working group be set up to look into advancing amateur utilization of digital techniques and suggests that amateur systems be compatible with commercial technology. Soifer said that he had expressed the opinion that AMSAT should agree to participate and authorize the President to designate one or more appropriate representatives. He said that AMSAT's participation would involve having a technically qualified person who is familiar with both digital techniques as well as with the real world of amateur communications and know what real hams do and want. The sense of the Board was that AMSAT-NA should participate and Baker will follow up on this.

Tynan asked Soifer if the \$1300 budgeted for International Affairs in 1999 was adequate? Soifer said that the \$500 allocated for travel might be insufficient if more travel is required beyond that to the AMSAT-UK meeting in Surrey and he suggested that this amount be raised to \$1,200. He was advised that the daste proposed for the IARU meeting in San Diego would be October 10 and Soifer responded that because of the large international contingent expected there could also be an ARISS meeting as well. Baker will contact Bauer regarding this.

Clark asked if there was anything said at the Region 2 meeting about human flight activities? Soifer said yes, that they passed a resolution of his stating that the Conference recognizes that Amateur Radio operations aboard manned space stations have unique potentials for promoting Amateur Radio, especially among young people and in countries with limited satellite activity. The Conference recommends that Region 2 support the work of the IARU Satellite Adviser in promoting inter-regional cooperation toward facilitating amateur radio operation aboard manned space stations in order to promote Amateur Radio among young people and in countries with limited satellite activity. The Secretary of Region 2 is requested to bring the recommendation to the attention to Regions 1 and 3. Soifer said that the purpose of this is to express the support of Region 2 to the IARU Satellite advisor in his efforts to obtain inter-regional cooperation in frequency planning for the International Space Station. It was asked that Soifer inform Bauer of this action.

After Soifer concluded his call, Daniels mentioned an issue that is expected to be brought up at the next World Radio Conference that involves in-band and out-of-band interference. The recommendation has been made that in this regard satellite activity should be bound by the same rules as terrestrial activity. Thus, spurious signals should be reduced by 60 dB across a 250 percent of the bandwidth. He said that this will be presented at the next World conference. Feller said that we've been using good engineering practices for the satellites AMSAT has built and why get into this at all? Daniels replied that he understood that there have been numbers established in every area other than for space satellite activity and this is an effort to bring satellites into compliance. It's now beyond the point where we could comment on it and he didn't think it will cause us a problem. Tynan speculated that, in the future, we will have to prove that we meet the specifications before we launch a satellite.

Daniels reported that another thing that's been asked for by Paul Rinaldo and Walt Ireland is a complete model for all amateur systems from receivers through transmitters and to include transmitter power, receiver gain, ground station receiving gain, antenna gain, etc. Tynan said that Wood and McFadin have this information for Phase 3D and that some of it has appeared in our publications. Feller pointed out that these characteristics are part of the submission to the ITU and we've made notifications as far back as OSCAR 7 and 8. Clark contended that what they are looking for is not only the segment in space but also the ground segment and we should never have to do that because there is no such thing as a typical amateur station. Tynan said that they had asked for ground station data in the past. Daniels suggested that we be ready to handle the issues when they come up. Clark agreed that we do know the numbers and those are precisely the numbers we had to file with the ITU for every satellite we've flown. Daniels agreed but said they don't have that for Phase 3D. Tynan noted that information on Phase 3D has already been published. The question of filings needed for Phase 3D were discussed and Baker agreed to take the matter up with Karl Meinzer.

X. Strategic Planning Process for AMSAT-NA

At last year's meeting the Board recognized the need to do some forward planning and asked Bill Burden to assist in planning for the future. Thus, he presented his document proposing a strategic planning process for AMSAT-NA and asked that the Board consider the suggestions made therein before the 1999 meeting. Burden then mentioned his past experience in strategic planning, including that with the ARRL, his former employer, and several other non-profit organizations.

Burden proposed that AMSAT needs to decide what it wants to do. Does it primarily exist to build satellites, or is it mainly interested in educational activities? He went on to define how the process works, particularly the fact that changes are usually made incrementally and that objectives may have to change during the process as a result of technological changes or other changing external factors. Daniels commented that when AMSAT started we were the only game in town and now we are not. A lot of organizations are doing exactly the things we set out to do. He contended that this fact needs to be considered, as one such external factor, in framing a mission statement. Burden contended

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in AMSAT's case that it is necessary to look forward 3 to 5 years. He further stated that a Mission Statement should be drafted which states, preferably in simple terms, the objectives of the organization. He used the simile of a galley boat in which a number of people are rowing and maybe one person is steering. He said that the Board should *steer* rather than *row*. He also said that it is vital to have the complete participation of the organization's leadership in the process. Burden said that he plans to send additional information to all those designated as participants. It was concluded that the plan will be an integral part of the agenda for discussion and action.

Baker noted that this is something the Board has tried to get started in the past and this time we will make progress by regularly taking small steps to achieve a large goal. Daniels registered agreement with Burden as to the need to continually consider changes in the external environment. Historical antecedents were discussed and Burden called attention to AMSAT's Bylaws and Articles of Incorporation and made suggestions how this wording could be summarized and enhanced to provide a Mission Statement. Saragovitz agreed to provide a copy of the By Laws for inclusion on the web site for use by those working on the Mission Statement. It was pointed out that one of the issues the Board is struggling with is getting AMSAT into the educational realm and that that is one of the things you can sort out with a planning process like this. Burden summarized by stating that the BoD should think about the organization as it is to be in the future and that the plan should be what AMSAT actually intends to do, not something that will be put

on the shelf and forgotten. Baker stated that the statement we come up with should be used to judge the advisability of taking on proposed new projects.

XI. Operations Report

Keith Pugh noted that, because Phase 3D has not yet been launched, the past year was relatively uneventful for his department. After the Dayton Hamvention there had been discussion about APRS usage on AO-16 and a consensus was reached that it was welcome and that one day a week is to designated for APRS experiments. There have been suggestions that this schedule should be expanded. He noted that the other digital satellites are not under our control.

He also noted that AO-10 is still operational and that activity was spectacular on Field Day.

As to Net activities, Pugh said that he has been running the 20 meter AMSAT net with recent help from Larry Brown in Tucson. Propagation on 15 meters is being monitored to see when it will be satisfactory to resume nets there. He expressed doubt that a 17 meter net would be reestablished. Activity on the 75 meter nets has not been great, with greater participation on the East Coast Net than on the Mid continent Net. The West Coast Net has not been heard from in some months. Haighton said that a successful 40 meter net has been started in the Toronto area. Daniels questioned the need for the nets in the light of the large volume and redundancy of information found on amsat.bb wherein the same message and usually from the same source will show up also on ANS and Space News. Tynan pointed out that ANS is the official AMSAT medium while

amsat.bb is anything but that. A brief discussion followed of the bulletin board as a source of information for the satellite community. MacAllister contended that the nets are an essential activity. Pugh agreed, mentioning some of the features of the AMSAT nets, e.g., preceding the Sunday afternoon 20 meter net preceding there is a pre-net session for questions, answers and comments. There are still a number of VHF nets active, notably the Houston Net which is retransmitted via commercial satellite to a number of repeaters around the country.

Discussion returned to APRS activity on AO-16. Clark mentioned Bruninga's enthusiasm for the TRAKNET system noting that satellite services are needed in areas of low population density and that the system is largely interconnected via the Internet. Clark said AMSAT should encourage experimentation in this area. Tynan stated that the BoD would like a report from Bruninga concerning the results of APRS activity on AO-16 and would welcome a proposal from him as to what more AMSAT might do to support APRS activity. Clark said that if it takes some special orbiting hardware we should be targeting what needs to be done. Tynan commented that the APRS experiment was a good one for a simple satellite. Pugh was asked to communicate these thoughts to Bruninga. Clark cited some reasons why it would not be a good idea to make AO-16 wide open to APRS usage. AO-16 appears to still be healthy and is expected to remain operating for several more years. As an aid to planning its further use, it was suggested that Robert Diersing be asked for information about general AO-16 usage. Pugh agreed to do so.

XII. The AMSAT JOURNAL

Editor Russ Tillman spoke about the objectives of the *Journal*, namely to chronicle AMSAT's accomplishments but not to be primarily a source of news since AMSAT has other more efficient mechanisms for that. He is looking for ways to improve the content and quality of the publication and to use it to support AMSAT's goals such as helping to increase membership. He then mentioned some internal housekeeping improvements that might be made such as providing guidelines for authors and making improvements in the way digital photographs are handled. This might be achieved by upgrading the present 300 dpi printer and adopting software to allow our current printing company to go directly from a digital format to what is needed to print the *Journal*. Baker said that funds for a new, higher resolution printer are in the Budget and Tynan confirmed this. He also said that unless we upgrade the present laser printer we should ask authors to submit photographs only on paper. Tillman said we owe it to our authors to provide guidelines about how to submit manuscripts and photographs and that he intended to accomplish this task in the coming year.

The budget for the *Journal* was approved as presented.

Baker asked Tillman if he would be willing to assume the office of Vice President for Publications. This would include responsibility for supervising all AMSAT publications. Tillman indicated his willingness to serve and the President appointed him to this position.

XIII. AMSAT Internet Facility

Williamson reported that automation has been installed and is working well with approximately 10,000 aliases on the mailing list. One problem was encountered with someone grabbing the entire list and sending a spam message. As a preventive measure we now have a more restricted availability wherein a user can ask if a certain callsign is a valid alias but receives only a "yes" or "no" and not the actual e-mail address. He said that the only hardware failure was a minor one that was fixed with a junk box part at no cost although sooner or later a serious failure will occur. The hardware is now old enough that it will be impractical to replace parts piece by piece and the next time a major failure occurs an upgrade will be needed. Clark asked about the available disk space and Williamson replied that there are 1,600 megabytes of which about half are used so there is still room for growth. If a big project like archiving telemetry is undertaken this will also require an upgrade. The next time a hard disk failure occurs one with a larger capacity will be obtained. Clark asked if UCSD could provide a backup in the event of a failure and the reply was that in theory they could but this has never been tested.

Tynan said that there was a total of \$500 budgeted for Electronic Publishing and asked if that would be sufficient? Williamson said it would probably cover any failures expected during the coming year. Feller asked what the cost would be of replacing the entire system and the reply was that to replace and upgrade, the amount would be only be about \$1,000 because a monitor is not required and only a modest hard drive is needed.

Tynan brought up the arrangement of subjects on the web site saying that numerous, mostly university sponsored projects are continually being presented to us and that there needs to be something on the front page to make it easy for these people to find what defines an amateur satellite. He said that King had specifically requested that we make note here of his concerns regarding the use of amateur frequencies by non-amateur projects. Williamson replied that there were already too many things cluttering up the front page. Baker agreed with Tynan that it's sometimes difficult to find topics 4 or 5 layers down but he agreed with Williamson about the front page. Williamson said that he feels that there is too much on the front page anyway. Baker asked if a search engine could be placed on the page. Williamson answered that it could and that he would like to do this in the coming year. A discussion of possible ways to improve the web site followed and Clark suggested recruiting a small group of knowledgeable persons to evaluate the site's organization and ease of use. Williamson mentioned some of the technical considerations of establishing hierarchies and grouping things.

Tynan then mentioned the suggestion made at the Symposium that only AMSAT members be allowed to subscribe to *amsat.bb* and some of the other services. He said that this issue has been brought up in the past and submitted his view that the present open policy should remain in place. Williamson agreed and said that the main point was that the bulletin board should be an open, free forum for discussion of satellite affairs and that AMSAT should be the sponsor. Burden said that only about 3/5 of the mail aliases are AMSAT members. Williamson said that it's a very international group and it's a free service to the Amateur Radio

community. It was the sense of the Board that access should remain free to all. Baker said that he had received many favorable comments at the Symposium about the AMSAT web site.

Williamson noted that the site is now providing two additional courtesy pages, one for AMSAT Sweden and one for AMSAT Bermuda. The Board thanked Williamson for his excellent work and he replied that he would be happy to continue it for another year.

XIV. Small Satellite Conference

AMSAT was represented at the 1998 conference by McFadin who reported that it was enjoyable and an excellent place for AMSAT to *show the flag*. He was able to meet industry representatives and other persons working in the field of small satellites and had seen a lot of innovative new technology. He added that he believes it very important that we send someone each year to make a presentation at the forum because AMSAT is one of the original initiators of the activity and we need to show what we are still doing. Tynan agreed, noting that he attended the Conference the year before. He said that he went because he was *selling*, and it was there that he met the MOST people. That, in turn, led to our participation in MOST and the agreement that was signed.

It was learned in informal discussions that several organizations are putting up large numbers of very small satellites called Nanosats, some the size of a basketball. He found this alarming because they are in high orbit and will remain as space junk after their mission is fulfilled and he encouraged AMSAT to discourage this activity because of the damage such debris could cause to other spacecraft. Tynan said that AMSAT should consider this in our deliberations about future project, for example many small satellites or a few wide area coverage satellites. McFadin noted that Phase 3D will not leave such debris.

McFadin said another unsettling subject was the considerable number of university people who said they were going to use Amateur Radio frequencies for their satellites. Fortunately King was there and spoke at a meeting where he diplomatically explained that just because it's an Amateur Radio frequency it wasn't free for any use. Tynan advised that's why the document defining what is an amateur satellite should be readily available to all persons. McFadin said that there is a definite need to have someone from the amateur community there to explain to these groups what amateur frequencies are for. Feller said that there is process whereby government money may not be spent on a project that requires radio frequencies unless the NTIA has provided that frequency support. Daniels pointed out that on one hand we would like to encourage universities in these activities under one set of rules and on the other we may be trying to discourage those who don't play by the rules we have established. McFadin said that AMSAT needs to develop a policy whereby we encourage universities to do ham radio projects and not exclusively for scientific experiments. Feller pointed out that there are frequencies available to non-government agencies for this in several services such as the exploration satellite service. The Board asked Feller to review the overall frequency allocation situation with the FCC. Baker said that you can then provide this information to those groups as alternatives to

using ham frequencies. Tynan said that it should be made clear that the MOST project itself is not an Amateur Radio project and will not transmit in the amateur bands. Haighton added that it is licensed by the Canadian government. Daniels said that King had suggested the establishment of a new service for use by universities but that even if this could be done it would take 10-15 years to implement. Tynan said another alternative suggested by King was that the amateur rules be changed to permit communications, such as scientific data, that had not been considered appropriate on amateur frequencies in the past to take place on certain specified frequency segments - segments not generally used by amateurs. He cited 2410 to 2420 MHz as a possible example. The Board will await Feller's report before taking action on this subject.

McFadin concluded his report by noting that he had asked several launch organizations attending the Conference about launch possibilities for Phase 3D and the answers for the most part were not encouraging. He did find a firm making dynamic analysis software who agreed to contribute an analysis of the Phase 3D solar panel deployment.

Daniels returned to the subject of University sponsored satellites and said that he had made contact with the University Space Research Association (USRA) whose purpose is to match universities who want to launch satellites with NASA. He volunteered to talk to USRA about the frequency issue and possibilities for a Phase 3D launch.

XV. Public Relations

Baker concluded the day's session by announcing that he would like to appoint Dan James to become VP for Public Relations to take over the work he has been doing in handling public affairs including the preparation of press releases. Baker added that James has been doing our ANS bulletins, has experience in broadcasting and writing and has agreed to accept the position. The Board expressed their approval and the meeting adjourned for the day at 11:00 pm.

XVI. Executive Session

The meeting resumed on Sunday morning at 8:30 am and went into a closed session to deal with administrative matters including Saragovitz's performance review and compensation. While no record was made of the proceedings it was subsequently mentioned that Martha will be granted an increase in pay as a result of continuing good performance and in recognition of an increase in the cost of living.

XVII. Other Office Matters

The open session resumed at 9:30 am with Daniels bringing up another topic related to office operations. It is the assistance provided by volunteer help. It was concluded that this help was important to efficient operations. The volunteers are Bob Carpenter who has done a yeoman job of maintaining and improving the computer capabilities. He has exerted a sustained effort in establishing and maintaining the Phase 3D database of contributors. Recently he assumed the responsibility of ensuring that the office software is Y2K compatible. The other volunteer acknowledged was Bill Hook who converts the taped proceedings of Board meetings into minutes

for publication in the *Journal*. In addition, he tabulates results of the yearly elections and assists the Treasurer in expediting the payment of AMSAT's bills. Daniels offered the motion that a resolution be adopted expressing support and appreciation for the activities of these volunteers and voicing the hope that they will continue in this capacity. Tynan seconded and the motion carried.

XVIII. Auditor's Report

Feller distributed the audited Financial Statement and Management Letter for 1997 prepared by the firm of Verkouteren, Auerbach, Olsen and Co. Tynan moved that the audit be approved, Baker seconded and the motion passed with none opposed. Feller said that the accounting firm had done well for us and recommended that they be retained for another year. Clark so moved, Baker seconded and the motion was passed by unanimous vote.

XIX. Y2K Compatibility

Tynan said that the question of our compliance with the requirements of the next century had been brought up by Clark. Tynan stated that, in response to his questions on the matter, he has been assured that the office software, including the membership database, Phase 3D fund raising database and the accounting software are all Y2K compliant. However, as the report given at the Symposium by Roy Welch indicated, the situation with the satellite tracking software distributed by us is different in some cases. This is not something that the Board has control over. Clark said he had asked the question about the office software because the original version he wrote was probably not compliant. Tynan reiterated that Carpenter has looked at the present version and found it to be Y2K compliant. Clark said that he then does not recommend a formal Y2K audit of the business software, although we should exercise diligence. Clark thanked Carpenter for his timely and complete response to the problem.

XX. Field Operations Report

A written report was submitted by VP Barry Baines who was unable to attend because of his wife's recent surgery. The BoD wished Kathy Baines well. The report summarized needs for 1999 and they included to 1) recruit more Area Coordinators around the country, 2) develop more resources for Field Ops support such as presentations, 3) encourage greater communication with Field Ops team including restarting the Field Ops Newsletter, 4) hold more Satellite Workshops and 5) encourage the local and national AMSAT nets.

Baines' summary of the achievements in 1998 stated that the field organization remains strong with 147 Area Coordinators in the USA, 10 in Canada and 4 in other countries and all of them have e-mail capability with their addresses listed on the AMSAT web site. There are also materials for preparing presentations posted on the site. An automated system has been implemented to broadcast messages to the staff by e-mail and Baines has written the "Field Ops Update" column in *The AMSAT Journal*. It was noted that the Field Ops Breakfast at the Symposium was well attended.

Resource development continues with updated versions of AMSAT publications including *Working the EasySats* by N1JEZ (also on the web site), the *Resource Guide* by WD4ASW, the seventh

edition of *How to Use the Amateur Radio Satellites* by KB1SF and the *AMSAT-NA Digital Satellite Guide* by N7HPR. A new publication is the *Analog Operators Guide* by WA4SXM. Over 40 hamfests were covered to date in 1998 including the very successful Dayton Hamvention. Well attended Satellite Workshops were held at Orlando, San Diego and Vicksburg. To encourage greater AMSAT awareness the Net Listing is periodically updated, there have been AO-27 demonstrations and numerous presentations have been made to clubs.

Baker said that Baines was doing an excellent job and made the motion that he be commended for his work as VP for Field Operations, Tynan seconded and it passed unanimously. It was noted that Baines has agreed to serve in that position for the coming year. The Field Ops budget for a total of \$6260 was approved.

XXI. Prospects for Future Projects

This discussion began with the question of what our relationship is and should be to various projects. The opinion was stated that AMSAT does not get enough credit for helping with other organization's satellites. For example, when we lend expertise to a satellite project, AMSAT is rarely credited with helping and we need to make mention of this in *Journal* articles and on ANS. Examples of the help provided to several projects were mentioned and the point made that the AMSAT member involved should receive credit for their specific contribution.

Tynan recommended that AMSAT-NA should continue to offer to assign OSCAR numbers to satellites which meet certain established standards. The popularity of AO-27 was noted and contrasted with the satellites that require more sophisticated hardware to use. Daniels replied that, on the other hand, the hottest topic now is APRS and that reflects the fact that the world is going digital. Tynan contended that our objective ought to be to provide satellites that are available 24 hours a day and accommodate a variety of modes. Discussion returned to the subject of selecting an Amateur Radio project to accompany the MOST satellite. Clark said that we should immediately distribute a request for a short letter of intent from anyone wishing to propose a project. This would put those showing interest on the record, will show us what kind of more detailed proposals will be coming in and allow screening for appropriateness. If only a few letters of intent come in, a simpler and faster review process can be established. Haighton said he liked this approach and Tynan said he agreed because it brings in more people and provides them with a voice about as to what AMSAT should do. Daniels said that while we should not discourage the group that has already outlined a project, we need to hear from as many groups as possible because they will become the future leaders of the organization. Saragovitz asked if a good proposal came from person or group about which nothing is known how can we rely on them to do the job without a great deal of help? Tynan replied that in the second round we will ask for details about what and how they are going to do it and inquire as to their capabilities. Clark suggested some types of proposals that would not be acceptable including those that say "why don't you guys do this?" This should be stressed in the announcement and there should be the understanding that AMSAT might contribute to the cost of hardware. Clark and Haighton were asked to

collaborate on the wording of the solicitation and it was suggested that mention be made in the notice of the size, weight and antenna limitations. Haighton offered that in the event that MOST is successful there may be future opportunities to fly amateur payloads with Canadian satellites. McFadin offered the opinion that selection of a project should involve the VP for Engineering. Clark agreed that VP Engineering Wood should be included in these activities and added that AMSAT needs to grow in the area of RF technology. A prolonged discussion followed of how to develop various types of technology for future AMSAT projects. Daniels added insight as to how this was done in the past. Some satellite projects that may involve AMSAT were next considered. These included:

PHOTON, a satellite that is to point a retroreflector at a ground station as it passes over. It is contracted by the US Air Force to the University of Central Florida (UCF) and the Florida Space Research Institute (FSI). The latter two have expressed a desire to contract with AMSAT, or with McFadin as in individual, to provide technical advice and to mentor their students. Tynan noted this was another good opportunity for AMSAT to become involved with an educational institution and encouraged establishing an agreement with USF/FSI. McFadin briefly described the project including funding, facilities and their needs. McFadin said he had no problem with working through AMSAT to help them and noted that they have a large room available at a military facility where it might be possible to store Phase 3D. McFadin said he thought that USF/FSI would like AMSAT to initiate a proposal to provide mentoring and this would likely bring some funds to AMSAT to help keep the Phase 3D lab open. Baker said that the consensus appeared to be that this opportunity should be pursued and he asked Tynan and Haighton to assist him in this. Daniels recommended that the initial approach to UCF/FSI should be a letter rather than a proposal because a discussion is needed before deciding what to offer. Saragovitz cautioned that if we are offering the same people that are involved with MOST that might be spreading them too thinly. Daniels noted that AMSAT is moving in the direction of providing mentoring and assistance rather than coming up with projects of our own and there needs to be a conscious decision to move into this rather than discovering that's where you've ended up. Feller described the options by which AMSAT could receive financial contributions for their participation. Daniels countered that there will be time and effort required in maintaining a contractual relationship and you may thus become a business operation. Haighton said that Wood must be brought into this group and this was agreed upon. Daniels recommended that the Board defer formal action on this matter until there was something firm to vote upon.

CITIZEN EXPLORER is a small satellite being developed by students of the Colorado Space Grant Consortium (CSGC) to measure atmospheric ozone and UV radiation. At last year's Small Satellite Conference Elaine Hansen of the University of Colorado made it known to Tynan that they wanted to make it an Amateur Radio satellite. Tynan referred her to the guidelines on the AMSAT web site concerning what is an amateur satellite and later he was advised that they would still like to continue with that purpose and would like the participation of amateurs around the world in

receiving data from the satellite. AMSAT has provided help in providing information about frequency allocations, required notifications, and etc. but not in terms of detailed satellite design although King has provided some advice. Tynan opined that from the presentation by CSGC at this Symposium it appeared that more technical help is needed. Whether or not we can provide such help is still an open question. Daniels offered to establish a point of contact at USRA and learn more about the project. Tynan asked for a consensus that AMSAT should do nothing more now than what we are already doing and if they ask for more we will have to discuss it. Clark noted that CSCG is using the AMSAT logo on their promotional literature and Feller asked Saragovitz to send a letter advising them of the that AMSAT's name and logo are subject to copyright rules. Clark prompted that some members were involved with the project because of their AMSAT connections. It was noted that King has not reported back to AMSAT on this project. Daniels said that there are so many things of this type going on that it will require staff to provide the interface and he suggested appointing an individual who is familiar with the technical and administrative aspects as well as one who knows the people involved. He added that at this stage the person acting in this capacity need not have a title or a department. Baker agreed that there is a need here for a person to coordinate with and get feedback from the various projects and he suggested Daniels for the job and Daniels said he would try it.

JAWSAT is an experiment of the Marshal Space Flight Center that has expressed interest in operating on the amateur bands. Feller said that he had suggested that they go back to the NASA Frequency Coordinator to see about getting non-amateur frequencies. Baker said they are talking about putting a separate amateur transponder on it. Clark opined that the first criteria is that the format of the data must be freely available to and of interest to amateurs.

Two commercial projects were discussed in which AMSAT may be asked to participate. Baker said that one of these is the notion of placing an amateur repeater on the Moon which had been reported by former VP for Operations, Courtney Duncan, following his attendance at the Space Frontier Foundation Conference in Los Angeles. There, Duncan heard about the possibility during a presentation given by a representative of Applied Space Resources Inc. who described their plan to acquire material from the moon and return it for sale. In the discussion that followed another Conference attendee told the speaker about AMSAT and its activities and suggested contacting us. Baker had not yet heard from the company. The Board discussed some of the technical and international treaty reasons why trying to place an amateur repeater on the Moon might not be a good idea. A company called SpaceDev is another commercial enterprise that may want to involve itself with Amateur Radio and AMSAT. The plan of their founder for a satellite to visit an asteroid was mentioned in the minutes of the 1997 BoD meeting and recent information reports that Mars may now be the preferred destination. It was noted that Jan King is now an employee of SpaceDev.

XXII. Future of the AMSAT Orlando Facility

It was stated above that it will be necessary to keep the lab open longer than originally planned.

Wood was asked if the Airport Authority would be willing to extend the lease on a month to month basis after it expires in November. His answer was that he thought they would. Tynan noted that it appears that financial help from AMSAT-DL will be required to stay operational through the end of February. Beyond that, it appears that we must be prepared to carry on without paid staff. Because of the uncertainties involved Board action was deferred until a telephone meeting in mid-November following completion of the thermal/vacuum testing.

Tynan suggested that money be put into department 13, New Projects, to give the President an opportunity to pursue promising leads. He noted that he was forced to spend money in connection with our preliminary work on MOST, without budget authority to do so. A discussion followed and it was the consensus of the Board to put \$5,000 into Department 13.

XXIII. 1999 Budget

Clark made the motion that the Budget for 1999, as presented and amended, be approved with the exception of Department 10 (Phase 3D). Feller stated he had looked at the income side and agreed to it. Daniels seconded and the motion passed by unanimous vote.

XXIV. Miscellaneous Items

Tynan announced that the article titled "A Common Date/Time Standard for Amateur Radio" by Ian Galpin appearing in the July/August 1998 issue of *The AMSAT Journal* has suggested that we adopt a common or several closely related formats of the ISO standard. Subsequently, the BoD was asked to consider this item. Clark offered that AMSAT should recommend, but not adopt, that in all cases where dates and times are reported, that the individuals working on publications and software attempt to adhere to the ISO standard. Williamson said that this was too strong and the format should conform to the usage appropriate to the readers or audience involved. After much discussion Daniels opined that this was too big a problem to resolve at a single meeting. Clark then restated his recommendation in the form of a motion that the BoD should advise those doing publications and software for AMSAT to be considerate of the fact that there are numerous formats in use around the world and to make certain that their date/time formats are unambiguous. Baker seconded and the motion passed with one member (MacAllister) abstaining.

Saragovitz noted that AMSAT will celebrate its 30th anniversary in 1999 and suggested that a special decal or patch commemorate this and be made available. She asked that a request for designs be announced in *The AMSAT Journal* and on ANS.

XXV. "Atta-boys" and "Atta-girls"

The following persons in addition to those mentioned in the text above were recognized for their contributions to AMSAT:

- Russ Tillman and the Organizing Committee for this Annual Meeting for their superb job in setting up the conference and all the facilities where things ran exceedingly smooth, the hospitality fantastic and the food was excellent.

- The crew at Orlando for working long hours on our behalf at the Phase 3D facility.
- Perry Klein for his help to those groups planning to build satellites and needing information about frequencies and similar matters.
- Ray Hoad who does a wonderful job in pulling together and distributing the Keplerian elements each week.
- Walt Rader for serving as manager of the QSL Bureau.
- *Journal* Editor Tillman and his helpers Ron Long, Buzz Gorsky, Andy Reynolds, John Bubbles and Bill Hook in editing and proof-reading.
- Retiring President Bill Tynan, now elected as Chairman of the Board, for all his long years of service to AMSAT and to Keith Baker who assisted him as Executive Vice President for all this time.
- Those at Orbital Sciences Corporation for assistance in Phase 3D testing and to Pat Kilroy for getting the volunteer crew organized.
- Those in Canada including Robert Zee, Kieran Carroll and Peter Hughes for putting up with us and making an effort to plan for an Amateur Radio package to fly with the MOST project. In addition, there were others including Paul Messier, VA3PEM who assisted Robin Haighton during AMSAT's visit with transportation and other arrangements.
- Steve Bible, an unsung hero, for helping with a lot of things including pulling together publications and helping to coordinate with TAPR.
- All those involved with the AMSAT Nets, especially Andy MacAllister and Bruce Paige for the Houston Net which is presently one of our best tools for maintaining interest.
- Dan Schultz for helping to serve as a purveyor of the truth about AMSAT.
- Paul Williamson for support of the AMSAT web site.
- Robin Haighton for help with the MOST contract and to Martha Saragovitz and Art Feller who reviewed it.
- Those teams who recently launched or will soon launch satellites including GURWIN, SUNSAT, TMSAT, and SEDSAT.
- Bob Twiggs for formulating an interesting program introducing Amateur Radio Satellite Technology at Stanford University.
- Mark Kanawti, Dino Lorenzini, Harold Price, Lyle Johnson and Chuck Green who are always there to lend a hand to an individual or group that needs help in the development of their project.
- All those who showed up, some more than once, at Toronto to help with MOST even before we had a solid agreement and freely contributed their time and talents.
- The entire membership of AMSAT for sticking with us for the past eight years during which time we have not launched a satellite.

XXVI. Adjournment

The motion to adjourn was made by MacAllister at 12:45 pm on Monday October 19, 1998, Baker seconded and it was passed by unanimous vote. The Board will reconvene by teleconference on or about November 10, 1998 to review the Phase 3D situation and other matters. ■

WORLD WIDE RADIO

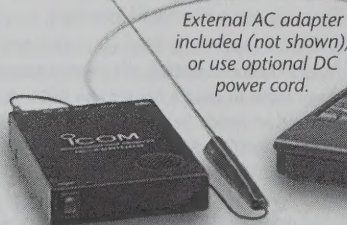


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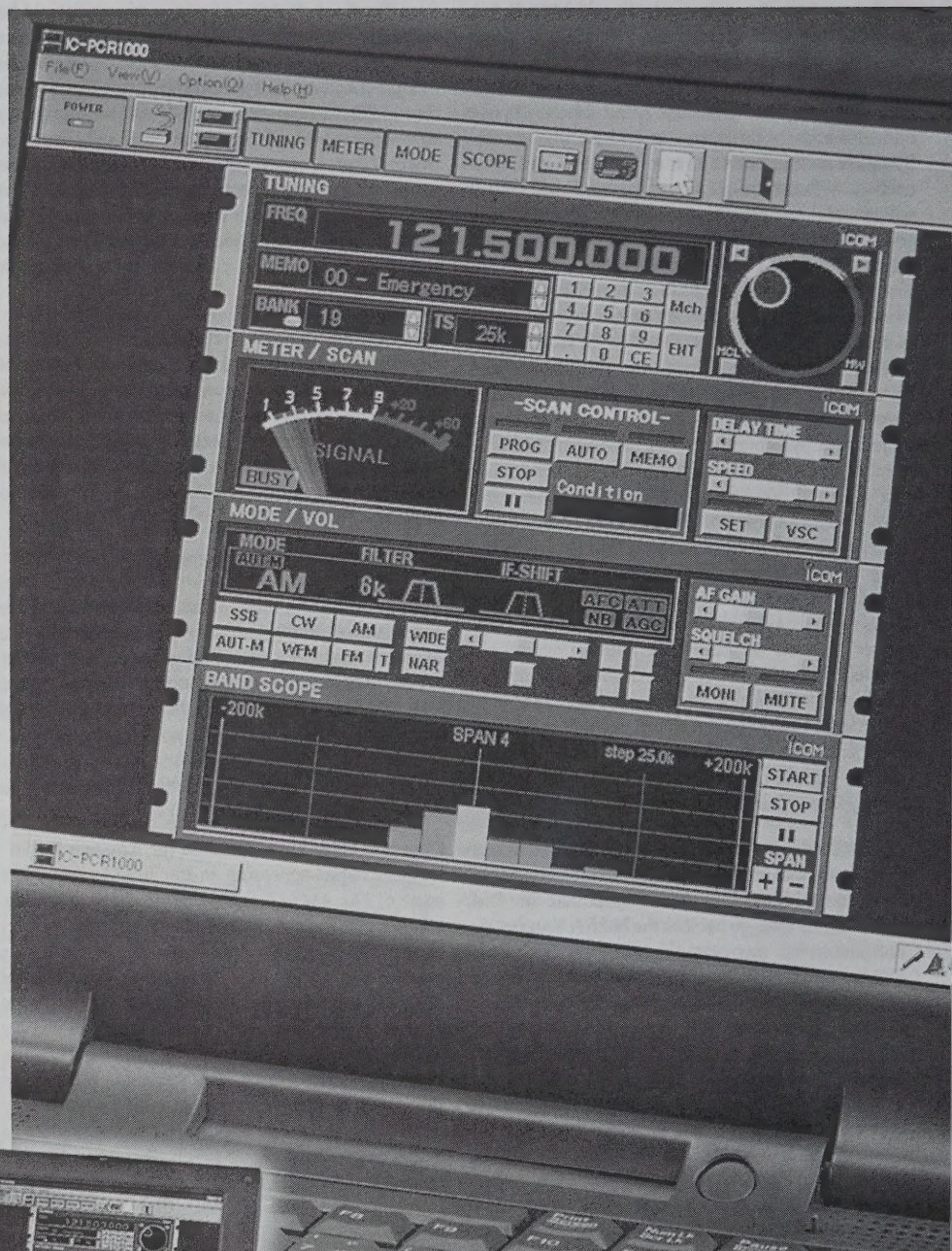
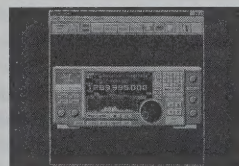


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